University of Alberta Library
0 1620 2533882 1

For Reference

NOT TO BE TAKEN FROM THIS ROOM

Ex libris
universitatis
albertaensis

BRUCE PEEL SPECIAL COLLECTIONS LIBRARY

UNIVERSITY OF ALBERTA

REQUEST FOR DUPLICATION

Name and address _____

Pages copied _____

Date _____ Signature _____

Name and address _____

Pages copied _____

Date _____ Signature _____

Name and address _____

Pages copied _____

Date _____ Signature _____

Digitized by the Internet Archive
in 2026 with funding from
University of Alberta Library

https://archive.org/details/0162025338821

THE UNIVERSITY OF ALBERTA

RELEASE FORM

NAME OF AUTHOR Dana Edwin Dolsen

TITLE OF THESIS The Catch-and-Release Trout Management Program in Alberta: An Analysis of Angler Response and Relevant Biological and Social Science Variables

DEGREE FOR WHICH THESIS WAS PRESENTED M.Sc.

YEAR THIS DEGREE GRANTED Fall, 1986

Permission is hereby granted to THE UNIVERSITY OF ALBERTA LIBRARY to reproduce single copies of this thesis and to lend or sell such copies for private, scholarly or scientific research purposes only.

The author reserves other publication rights, and neither the thesis nor extensive extracts from it may be printed or otherwise reproduced without the author's written permission.

THE UNIVERSITY OF ALBERTA

The Catch-and-Release Trout Management Program in Alberta: An Analysis of Angler Response and Relevant Biological and Social Science Variables

by

Dana Edwin Dolsen

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF M.Sc.

IN

Wildland Recreation

Department of Forest Science

EDMONTON, ALBERTA

Fall, 1986

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Catch-and-Release Trout Management Program in Alberta: An Analysis of Angler Response and Relevant Biological and Social Science Variables submitted by Dana Edwin Dolsen in partial fulfilment of the requirements for the degree of M.Sc. in Wildland Recreation.

DEDICATION

I would like to dedicate this work to my partner in life, Micheline Picard and our daughter Danique Sacha, who both inspired me to finish this thesis so we may proceed with our future together ....

Dana Edwin Dolsen

> Nonfishermen and too many fishermen ... fail to grasp that the live trout, lying in its sun-dappled riffles, rising over its bright-gravel shallows, and fighting the delicate rod, gives our sport its entire meaning.
>
> - Schweibert 1978:1560

ABSTRACT

A research study to determine the reaction of anglers to the experimental catch-and-release trout management program of the North Ram River and their receptivity toward this restrictive sport fishery management strategy was conducted with the sponsorship of the Alberta Fish and Wildlife Division.

A total of 266 stream anglers were randomly selected from four sites for personal interviews in the Nordegg area of the Rocky Mountains during the summer of 1983. A series of mostly open-ended questions was administered dealing with angler socio-demographics (e.g. age, education, socio-economic status); participation patterns (e.g. angling intensity and experience, technique use, distance travelled, membership in fish and or wildlife interest groups); preferences (e.g. fish catch, species, management strategy, recreational carrying capacity and quality angling attributes); communication channels and knowledge (e.g. fish and invertebrate identification and comprehension of the catch-and-release program); beliefs and opinions about the catch-and-release program (e.g. general and site-specific).

Responses regarding the catch-and-release program were categorized into four different characteristics as defined in the literature about innovations. A composite variable was constructed to measure the sample's level of catch-and-release acceptance, incorporating the program's relative advantage, complexity, compatability and trial potential as perceived by individual anglers. This score of innovation acceptance was then examined in relation to the parameters of the terminal tackle typologies developed previously in order to test the hypothesis that anglers who are more accepting and receptive of the catch-and-release program tend to be those trout-oriented anglers who had chosen to specialize in the more complex technique of fly fishing. Angler profiles for fishermen are presented as predictive indices toward understanding angler response and attitudinal variation to this regulation change.

The data indicate that an overwhelming majority (93%) of trout fishermen interviewed perceive the catch-and-release program as a worthwhile trout management concept, even though only 11% have had previous experience with such regulations elsewhere.

One-fifth (20%) of anglers interviewed were not willing to try angling at a catch-and-release fishery but 41% felt that there were positive benefits associated with a catch-and-release fishery, enough to attract them. Almost three-quarters of these anglers were convinced that an expanded catch-and-release program was warranted (70%), whereas only 10% directly opposed the use of such a restrictive strategy for managing trout fisheries in Alberta.

Fly fishermen were found to be the most supportive of the catch-and-release regulation and in addition to possessing the most experience with such regulations, they also possessed the highest resource knowledge level. Although fly fishermen were the most intensive group of those profiled, they also were mostly non-consumptive in their definition of what a quality fishing experience meant to them. These fly specialists were seen to represent a broader cross-section of society than previously believed in that they were well represented in both the lowest and highest socio-economic standings as well as having had a diverse range of ages and years of angling experience.

The relevance of considering trout fishermen terminal tackle typologies in conjunction with adoption-diffusion theory as applied to the catch-and-release program was supported. It is verified that for the initiation of either new and/or more restrictive regulations, the management agency needs to assess the characteristics of the catch-and-release regulation in relation to how the target wildlife user system perceives the proposed management strategy. Implications and recommendations for fish and wildlife management agencies are presented, in addition to a survey of biological and sociological criteria from the literature relevant to catch-and-release management with particular reference to cutthroat trout fisheries.

ACKNOWLEDGEMENTS

This research study has primarily been both funded and supported by the Alberta Fish and Wildlife Division, Department of Forestry, Lands and Wildlife. Appreciation and thanks is extended for their understanding and patience, especially to Mr. C. (Ernie) Stenton and Dr. Leon Carl.

Other financial support has been received from the Boreal Institute for Northern Studies, the Department of Forest Science and the General Research Fund of the University of Alberta. Many thanks for all of your assistance.

Logistical help was kindly offered and accepted from the Alberta Forest Service and the Department of Forest Science. Specific individuals who also assisted include Mr. T. Loblaw (Alberta Forest Service), and from various University of Alberta departments: Dr. R.L. Rothwell and Mr. A. Landals (Forest Science), Dr. T. Taerum and Mr. L. Marshal (Computing Services), Mr. W.E. Roberts (Zoology), and Ms. W. Lee (Educational Research Services). Ms. Mimi Hui, my textform specialist, deserves a special mention for her efforts, as does Ms. Judy Jacobs for her aid in the preparation and finalization of this document.

Other individuals who played a part in this endeavour include: Heather Pinnell, Bev Berteau, Nora Kopjar, Roy Finzel, Robert Purdy, Mark Hastie, Greg Fenton, Brian Braidwood, Doug Krystofiak and Roland Maw. Many thanks and best wishes to each and every one of you.

Specific credit is due to Dr. Bruce Dancik, Dr. Ed Jackson and Dr. Jim Butler, all committee members whose expertise and support guided this research endeavour. Special gratitude is reserved for Dr. Jim Butler and Elaine Butler for their cooperation, patience and understanding over the years past. I am indebted to you both.

Finally, like all graduate students, I too had special friends that kept me going, my thanks to Robert Beitz, Mike and Shirley Marchand, Paul and Pam Savoie and Chris and Louise Chesterman. I also wish to thank my parents, Erle and Kathleen Dolsen for their unabated faith in me and continued encouragement.

LIST OF TABLES

Table	Title	Page
1	Hooking mortalities of *Salmo clarkii* (Wydoski 1977).	20
2	Reasons for fishing for trout (Manfredo and Anderson 1982).	35
3	Degree of angling specialization and fishermen characteristics (Bryan 1979).	38
4	Adopter category characteristics and values (Rogers and Shoemaker 1971).	53
5	Fishery management preference by angler trout orientation.	70
6	Percentage of time fishing by distribution of Tackle Types.	71
7	Terminal tackle use by trout angler age.	74
8	Catch Preference by angler age.	75
9	Terminal tackle use by trout angler education.	77
10	Resource knowledge by angler educational attainment.	79
11	Terminal tackle use by trout angler socio-economic status.	81
12	Preferred fish catch by angler background.	83
13	Preferred management strategy by angler background.	84
14	Approximation of average mileage and driving time.	85
15	Regional breakdown of average mileage.	87
16	Terminal tackle use by angler intensity (days fished/year).	89

17	Preferred management strategy by angler intensity (days fished/year).	91
18	Terminal tackle use by trout angler experience.	94
19	Angling intensity by angler years of fishing experience.	95
20	Angler catch preference by years of experience.	97
21	Release belief by angler years of fishing experience.	98
22	Fish species and trout food sources identified.	101
23	Angler identification knowledge summary.	102
24	Resource knowledge by angler trout orientation.	103
25	Resource knowledge by technique use of trout anglers.	104
26	Importance ratings of experiential attributes.	110
27	Catch-and-release experience by angler resource knowledge.	115
28	Terminal tackle use by angler previous catch-and-release experience.	116
29	Catch-and-release acceptance by angler trout orientation and terminal tackle use.	131
30	Catch-and-release compatability by terminal tackle use.	132
31	Catch-and-release trial potential by terminal tackle use.	133
32	Catch-and-release acceptance by angler age.	136
33	Catch-and-release acceptance by angler educational attainment.	138
34	Catch-and-release acceptance by angler socio-economic status.	139

35	Catch-and-release acceptance by angler intensity.	140
36	Catch-and-release acceptance by angler experience.	141
37	Catch-and-release acceptance by angler sources of general fishing information.	143
38	Catch-and-release acceptance by angler catch preference.	144
39	Catch-and-release acceptance by angler resource knowledge.	145
40	Catch-and-release acceptance by angler previous catch-and-release experience.	146

LIST OF FIGURES

Figure	Title	Page
1.	Study area in relation to population centres.	6
2.	Study area - Shunda Creek and the North Ram River.	7
3.	Conceptual integration model of the trout fishermen social system.	26
4.	Angler orientation toward trout fishing.	68
5.	Angler age distribution.	72
6.	Education levels of anglers.	76
7.	Angler socio-economic status distribution.	80
8.	Angler levels of fishing intensity.	88
9.	Angler levels of fishing experience.	92
10.	Angler resource identification knowledge level.	100
11.	Angler sources of general fishing information.	107
12.	Angler sources of fishing regulation information.	108
13.	Angler creel preferences: fish quantity and size.	111
14.	Angler preferred fishery management strategies.	113
15.	Evaluation of catch-and-release: concept worthiness.	119
16.	Opinion on catch-and-release program expansion in Alberta.	121

17.	Stated release belief versus purported release behaviour of anglers.	122
18.	Previous angler experience with catch-and-release programs.	124
19.	Opinion on a permanent North Ram River catch-and-release program.	125
20.	Evaluation of catch-and-release: program participation willingness.	128
21.	Evaluation of the North Ram River catch-and-release experimental program.	129

LIST OF PHOTOGRAPHIC PLATES

Plate	Title	Page
1	Interview administration.	166
2	Uniformed agency personnel as a deterrent to angler non-compliance.	166
3	Anglers being interviewed during the investigation.	167
4	Density of recreation users at study location.	167
5	On-site regulation sign along the North Ram River.	168
6	Representative illustration used for the fish portion of the angler resource familiarity analysis.	168
7	Representative illustration used for the insect portion of the angler resource familiarity analysis.	169
8	An example of the signage used along the North Ram River catch-and-release sport fishery.	170
9	A typical trout-oriented fly fisherman.	171
10	Proper initiation of novices is crucial in the development of ethical anglers.	172

Table of Contents

Chapter — Page

I. INTRODUCTION 1

II. STUDY ORIENTATION AND OBJECTIVES 5

A. Orientation to the Study Area 5

B. Study Purpose and Objectives 9

III. RELATED BIOLOGICAL RESEARCH 11

A. Catch-and Release: An Historical Perspective 11

B. A Review of Hooking Mortality and Related Issues 18

IV. UNDERSTANDING TROUT ANGLERS: TOWARD THE DEVELOPMENT OF DESCRIPTIVE ANGLER PROFILES RELEVANT TO CATCH-AND-RELEASE PROGRAMS 25

A. Introduction 25

B. Experiential Components of Trout Angling 27

C. Summation and Relevance to Catch-and-Release Acceptance 41

V. THE CATCH-AND-RELEASE PROGRAM: AN INNOVATION TO ALBERTA ANGLERS 43

A. The Diffusion-Adoption Process 44

B. Characteristics of the Catch-and-Release Innovation 45

C. The Diffusion of Innovations 49

D. The Role of the Agency and Associated Individuals in the Process of Change .53

VI. METHODOLOGY 60

A. Survey Population 60

B. The Survey Instrument 60

C. Data Collection Procedures 61

D. Survey Sampling Procedures 62

E. Treatment of the Data 63

VII. RESULTS 67

A. Preamble 67

B. Clarification of Angler Terminal Tackle Typologies 67

C. Profile Development: Terminal Tackle Typologies 69

Socio-demographics of Anglers 69

Participatory Patterns of Anglers 82

Resource Familiarity of Anglers 98

Angler Communication Sources 105

Angler Preferences and Beliefs 107

Angler Exposure to Catch-and-Release Fishing 112

D. Receptivity of Sport Anglers to the Catch-and-Release Trout Management Program 117

The Characteristics of Catch-and-Release as an Innovation 117

The Relationship Between Technique Use and Angler Support of the Catch-and-Release Innovation 127

VIII. CONCLUSIONS AND RECOMMENDATIONS 148

Conclusions of the Literature Review 148

Study Conclusions 150

Recommendations of the Study 160

IX. PHOTOGRAPHIC PLATES 165

X. REFERENCES 173

XI. APPENDIX 188

I. INTRODUCTION

The broad appeal of wildlife-related activities to Canadians was documented in the results of a 1981 Statistics Canada survey which revealed that for 80 per cent of the population, the maintenance of healthy wildlife populations was fairly important (Filion et al. 1984). As the Canadian public's perception and participation with wildlife has grown increasingly sophisticated, so too has wildlife management in Canada. According to Butler (1983) there are five distinct phases of wildlife management agency development which can be predicted by changing agency viewpoints, priorities and philosophies. These phases, while not intended to be seen as mutually exclusive, usually progress from one to another, although they may also overlap.

The Protection Phase, when habitat designation/acquisition and steps for protecting high profile, declining species are initiated, marks the beginning. Next the Regulation Phase formalizes the consumptive use of fish and wildlife resources through rationing and seasonal protection. Third is a Biological Phase when sound biological management of game species occurs, but usually little emphasis is given to non-game species, and virtually none is given to the human management aspect. An Ecological Phase follows wherein a broadening concern for all wildlife is integrated with a comprehensive viewpoint for management of ecosystem integrity. The Sociological Phase may actually occur simultaneously with the Ecological Phase and is the start of incorporating human needs, satisfactions and impacts within sound resource management strategies. The understanding by resource management agencies of the users' attitudes, perceptions and behaviours enables the wise allocation of resources to various market segments which seek quality recreation experiences, and places value on the provision of these experiences by understanding what enhances or diminishes them.

The success of wildlife regulations that manage for the continued stability of the ecosystem, rather than short-term productive yield, is dependent upon these regulations being ecologically feasible, being acceptable to society and providing some form of human satisfaction or benefit (Firey 1980). Furthermore, without societal support, the enforced

imposition of regulations is the only effective solution. Unpopular resource use restrictions will create one of three behavioural responses, either: 1) non-compliance, 2) reluctant cooperation or 3) non-participation (Firey 1980).

In the spring of 1982, the Alberta Fish and Wildlife Division of the Department of Energy and Natural Resources announced the start of an experimental catch-and-release trout management program for the North Ram River cutthroat trout sport fishery. The fishery required immediate protection to ensure broodstock survival. For several years the cutthroat fishery had received intense angling pressure, and when untimely floods recurred frequently, the combined negative impact on population dynamics was severe. The Fish and Wildlife Division recognized that the catch-and-release no kill program would only achieve its biological goal if there were societal acceptance and support among trout anglers, so they commissioned this study to profile trout anglers and to determine their receptivity to catch-and-release regulations.

Since there has been a relatively abrupt shift in perceptions and behaviour over the last few decades, management agencies have endeavoured to maintain open communication lines with resource users whenever feasible. Over two decades ago, Gilbert (1964) emphasized the importance of focusing on the sociological aspects of human management so that sound biological management principles might be applied. The answer to proceeding with such ecologically sound practices is also expressed by Dahlgren et al. (1977:147) who stated that "wildlife managers should have less difficulty working with a public knowledgeable of the principles behind management policies.".

Current research indicates the importance for resource managers to identify user types and understand how they interact amongst themselves as well as how they each define a quality recreational experience (e.g. Schoolmaster and Frazier 1985). With such knowledge they will also be able to encourage more and/or new ethical behaviour by increasing user knowledge through improved public education (e.g. Krumpe and Brown 1982).

By matching user expectations with resource capabilities, ecological and recreational carrying capacities can be met through the provision of a tailor-made experience package designed to satisfy each segment of the recreational public. While the individual user will still have a personal choice, the opportunity will be present to select from a spectrum of experiences available. A catch-and-release trout management program provides a portion of the experience spectrum available to the trout angler. While it certainly will not attract all or even most of these anglers, it will serve an important segment of them and should prove to be biologically beneficial to depleted trout fisheries.

The purpose of this research is to develop an improved understanding of the implications and benefits of Alberta's catch-and-release trout management program, by assessing relevant biological and social science dimensions contained within the literature, and by describing and analysing responses and relevant behaviours and attitudes of Alberta trout anglers.

Through an improved understanding of trout anglers and how they perceive the benefits and limitations of catch-and-release regulations, methods for communicating the advantages of such managerial actions can be more clearly identified, and a spirit of mutual cooperation between managers and users may be fostered. Therefore, based on the angler profiles derived from this study, this document will suggest an approach which will facilitate user acceptance of catch-and-release programs and the most effective ways to communicate the program benefits in providing only one of a spectrum of quality angling experiences available. This will be accomplished through the application of a social science theory. Discussion of an innovation's adoption and diffusion within a social system and its relevance to Alberta's catch-and-release trout management program is addressed in terms of four characteristics inherent to an innovation: relative advantage, compatability, complexity and trial potential. A composite scalar variable is created to measure the sample's degree of acceptance toward catch-and-release incorporating the sample's scores determined for these characteristics. The descriptive terminal tackle typologies developed for trout fishermen from

the study sample in Alberta's eastern slopes will then be examined in terms of a hypothesized relationship with their degree of catch-and-release acceptance.

II. STUDY ORIENTATION AND OBJECTIVES

A. Orientation to the Study Area

The study area was located within the Rocky/Clearwater Forest in west central Alberta (Figure 1). Both Shunda Creek and the North Ram River flow into the North Saskatchewan River. While the former empties directly into the North Saskatchewan River, the North Ram River flows from its origin in the Ram Mountains in an easterly direction for fifty km where it joins the South Ram River, becomes the Ram River, which in turn empties into the North Saskatchewan River. Lodgepole pine (*Pinus contorta* var. *latifolia* (Dougl. ex Loud.)) is the predominant tree species along both of these streams. The area supports a diverse range of wildlife. The North Ram River follows a relatively flat but deep valley and Shunda Creek lies mostly along similar terrain not far from the Kootenay Plains Natural Area.

Traditionally, this area is very popular for its trout sport fishing. Prior to the implementation of the catch-and-release fishery on the North Ram River, angling for cutthroat trout (*Salmo clarkii* (Richardson)) was not permitted in even numbered years (i.e. 1978, 1980). Pressure on the fishery was generally intensive during open years contributing to an incremental stock depletion especially over the past decade as accessibility became easier. Shunda Creek, a brown trout (*Salmo trutta* (Linnaeus)), brook trout (*Salvelinus fontinalis* (Mitchill)) fishery, is open annually to sport fishing. Both fisheries are administered under the auspices of the Alberta Fish and Wildlife Division through offices in Rocky Mountain House and Nordegg - the closest service community for visiting anglers. Camping facilities are available along both streams, there being one campground at the intersection of the Forestry Trunk Road and the North Ram River and three campgrounds spread along a 15 km stretch of the David Thompson Highway which parallels Shunda Creek in the Nordegg area (Figure 2). From east to west, these Alberta Forest Service Recreation Areas are: Harlech, Shunda Beaver Dam and Upper Shunda Creek. In addition, there are numerous random camping sites

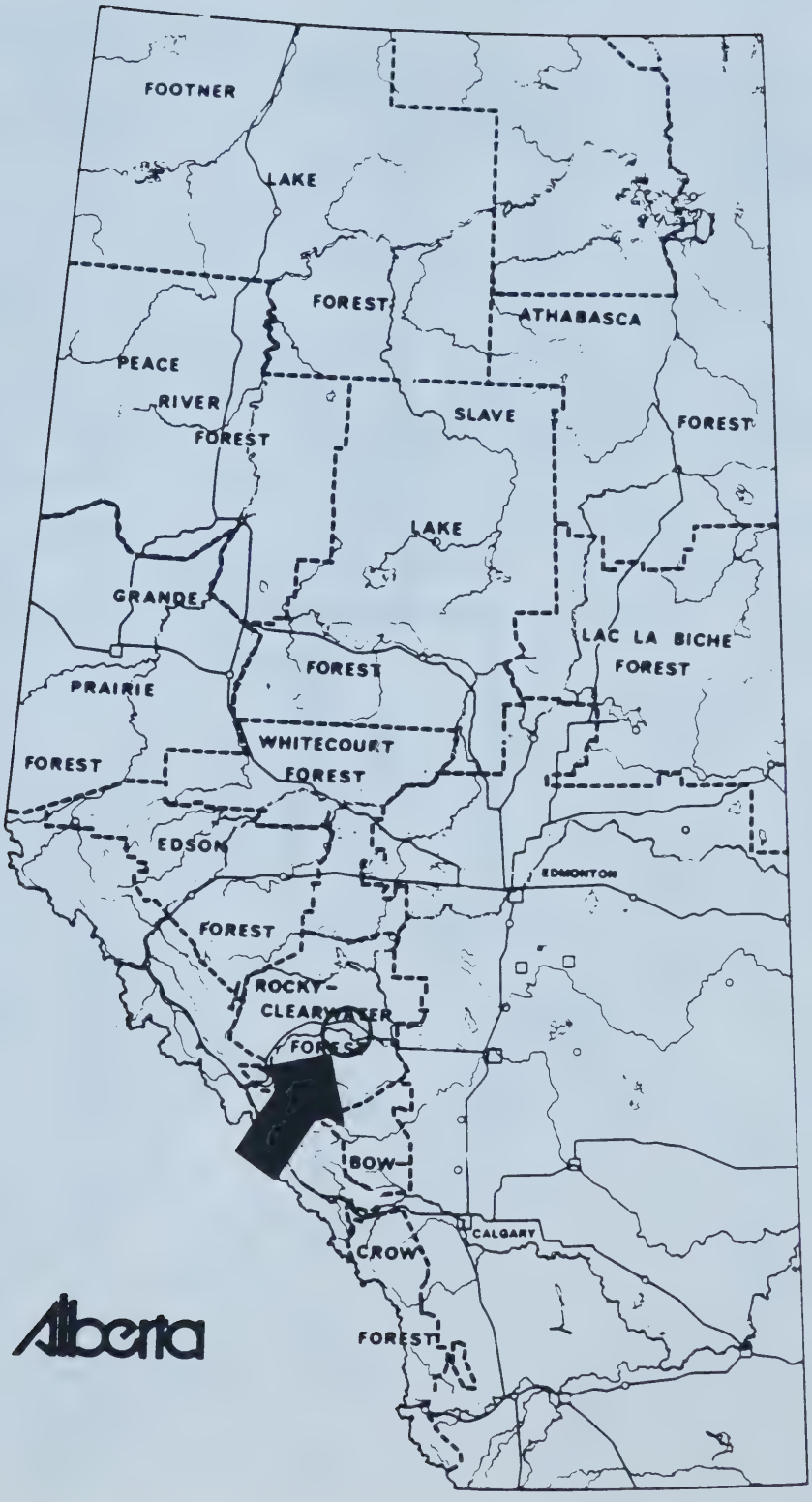


Figure 1. Study area in relation to population centres.

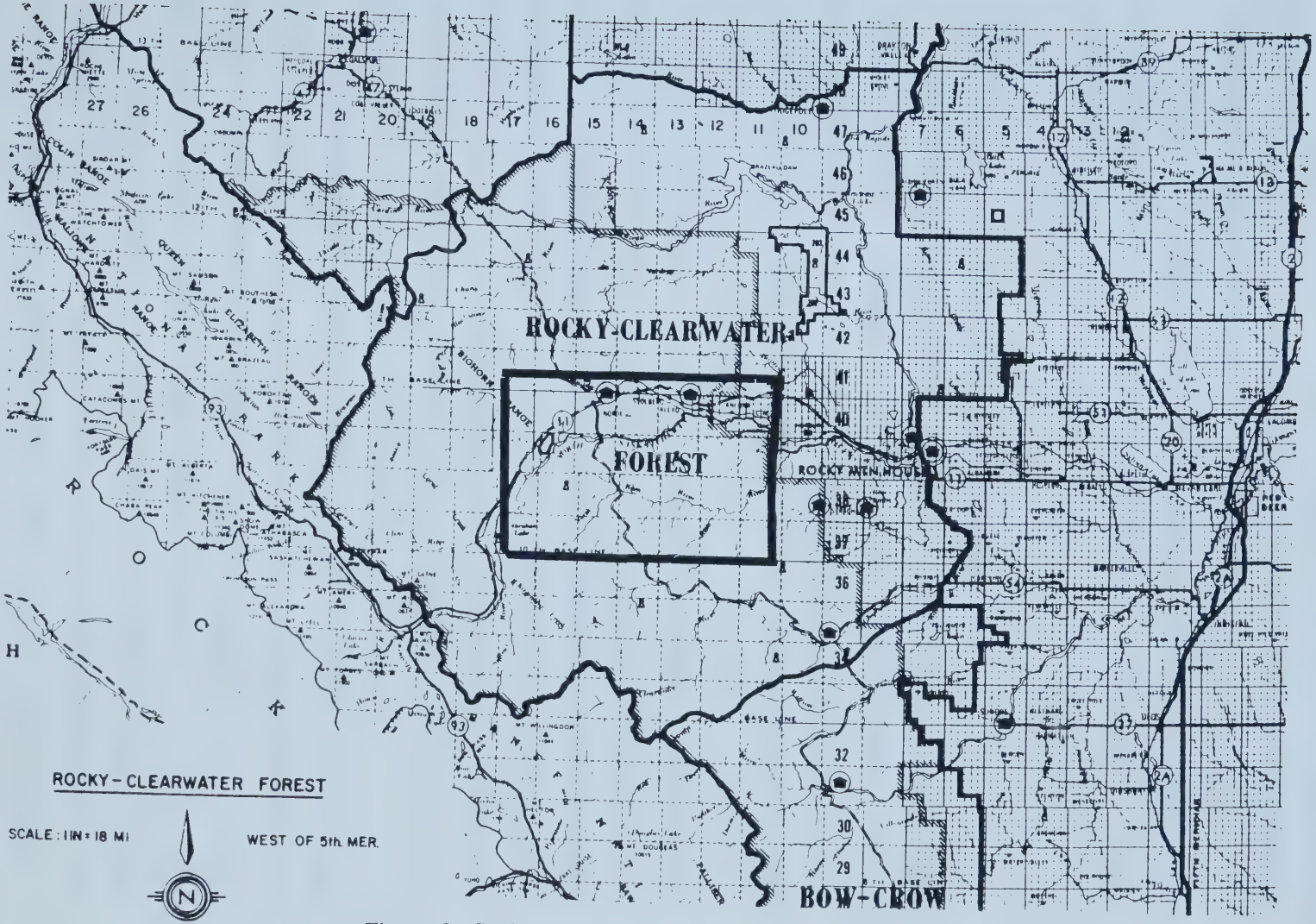


Figure 2. Study area - Shunda Creek and the North Ram River

along Shunda Creek and the North Ram River which are patrolled by both Alberta Forest Service guardians and Fish and Wildlife officers. Both of these governmental divisions have Nordegg-based offices which distribute public information throughout the summer.

The nearest service community of any appreciable size is Rocky Mountain House. This is over an hour and a half drive away and it probably receives the majority of the tourist dollars spent in the region west of Red Deer.

The North Ram River Cutthroat Fishery and Its Management

The North Ram River is shallow in depth, has a strong current and its substrate, overlaid on bedrock, is composed of fine silt and small rocks. Recruitment of fry and fingerlings from its tributaries is quite good since they generally have a low angle of entry into the main channel of the river. Over-wintering mortalities are relatively low and pose little problem.

Originally, there were not any trout in the waters of the Ram River system since waterfalls prevented the spread of fish throughout its length. There have been records of longnose dace (*Rhinichthys cataractae* (Valenciennes)) being present in the North Ram River in the mid-1960s (Roberts 1983, Pers. Comm.) but no other species have been mentioned. In the 1950s, the Alberta Fish and Wildlife Division stocked the Ram River with cutthroat trout (*Salmo clarkii* (Lewis)) obtained from south eastern British Columbia. These cutthroat trout have adapted well and have provided a quality sportfishery until recently.

There are two lines of thought expounded as to why the cutthroat population changed so very dramatically. While proponents differ as to which was the more damaging, both a series of unseasonable floods altering spawning substrate, in combination with the selective angler harvest of spawner-sized trout, caused severe stock depletion.

Angling for trout in Alberta is a high priority of sport fishermen (Longmore, Brickley and Stenton 1982). If the recreational demand for trout fishing opportunities is to be satisfied, the Alberta Fish and Wildlife Division needs to assess new ways of managing for

such experiences. For overly stressed trout species or populations, angler terminal tackle use must be managed for either protecting or rebuilding such sport fisheries since trout mortalities have been proven to vary according to the type of tackle used (Bouck and Ball 1966).

In order that the North Ram River cutthroat trout population could recover, the catch-and-release trout management program was introduced in 1982. This was a direct and deliberate manipulation of angler terminal tackle usage since the program prohibits the use of natural bait altogether, thus eliminating the impact of the most damaging type of all tackles to lower the overall rate of trout mortalities due to angling.

This logic demonstrates an already present criterion for recognizing the terminal tackle variable as the most valuable distinguishing profile characteristic for this study. Accordingly, while one researcher has previously selected a different conceptual base for understanding trout angler variations (Bryan 1979 - progressive specialization according to intensity and committment), this study delineates anglers according to their terminal tackle usage. The sample is described in terms of terminal tackle typologies with profiles being developed to provide a composite picture of sport fishermen in Alberta. Furthermore a rationale exists for determining how sport fishermen who angle predominantly (i.e. more than 50% of their time) for trout, perceive and evaluate the catch-and-release trout management program since they are the ones most affected by such a management policy.

B. Study Purpose and Objectives

Purpose of the Study

To measure the opinions, perceptions, knowledge and participation patterns of a sample of anglers through interview data, especially with regard to angler acceptance of the catch-and-release trout management program.

Study Objectives

1. To identify, isolate and measure differences in angler characteristics among the terminal

tackle typologies developed.

2. To elicit angler opinions of the catch-and-release trout management program.
3. To identify and isolate any associations between angler perceptions, knowledge and participation patterns and these terminal tackle typologies that may be relevant to the improved application of the catch-and-release trout management program for Alberta in general and the North Ram River in particular.
4. To test whether the angler typologies proposed reveal a significant variation among the subsamples and their evaluation of the catch-and-release program's innovation characteristics.
5. To examine the human dimensions of a wildlife management issue toward the development of a conceptual integration model of the trout fishermen social system for an improved sport fisheries program.

III. RELATED BIOLOGICAL RESEARCH

A. Catch-and Release: An Historical Perspective

Behnke (1980:58) defined special regulations as those "regulations that are designed to recycle all or a portion of the angler's catch by causing the release of all fish, or all fish below, above, or in between specified length limits.". Special regulations for trout have been widely applied due not only to the increasing popularity of trout fishing, but also to an increasing loss of habitat from the use of trout streams for electricity production, alterations for flood control and the emergence of multiple-resource use conflicts. Combined with greater access to wilderness areas, extraordinary pressure has been placed on our sport fishery resources.

It was not until the 1940s and 1950s that perceptive and concerned individuals began to advocate fishing for fun which involved a voluntary release ethic, although it had been proposed in the early 1800s, or even earlier (Wydoski 1976). Haig-Brown (1975:66), referring to a statement he made over thirty years ago, said that "The fisherman's enormous advantage in the matter of bag limits is that he can limit his killing without appreciably limiting his sport, and he can also select what he does kill in a way that is seldom possible in other sports.".

There have been reports of voluntary catch-and-release being practised on certain rivers for several decades, although active catch-and-release management application and research did not begin until the early 1970s. In Iceland on two rivers (the Grímsá and the Laxá í Adaldal Rivers), anglers have voluntarily released Atlantic salmon (*Salmo salar* (Linnaeus)) since the 1960s. Grant (1980:68) concluded that: "Atlantic salmon, fly-caught and released in fresh water, will survive to be caught again, providing additional sport to the angler, and will survive to spawn and propagate their kind.".

The catch-and-release concept did not seriously capture the attention of fisheries managers until the results from Dr. Ted Bjornn's research on Idaho cutthroat trout (*Salmo*

clarkii) became available and known in the early 1970s. His studies reported on probably the first successful application of special regulations designed to recycle fish, that increased the catch per unit effort, the average size and the proportion of large fish in a fishery. Similar results were described from Yellowstone National Park shortly thereafter, although application on other rivers such as the Battenkill in Vermont were really among the forerunners of the catch-and-release program in North America.

The first actual legislation for a catch-and-release program in Canada was passed by the British Columbia provincial government in the late 1970s. Billings (1982) reported that there was great concern about the decline of the steelhead (*Salmo gairdneri* (Richardson)) fishery, which in 1978-79 recorded the lowest catch value ever at 39,500. Specific results of the program in 1981-82 indicated that of the successful steelhead anglers, 1,645 (27%) had released all fish caught (Billings 1982).

Other Canadian initiatives with catch-and-release programs have principally been undertaken by private clubs and organizations in eastern Canada. Private endeavours with the catch-and-release no kill program have been undertaken on at least three Ontario rivers: the upper Credit River, Saugeen River and Cold Creek. On the upper Credit River two different stretches of over a mile in length each have been managed by two groups - the Stonecrop Trout Club and Trout Unlimited (Canada). The former group managed stocked brook trout (*Salvelinus fontinalis*) and the latter dealt with wild brook trout and habitat manipulations. On Cold Creek, several land owners have also been active in habitat improvements as well as regulating the stretch as no kill, flies only for both brown trout (*Salmo trutta*) and chubs (*Cyprinidae*). Another example of private concern in Ontario for trout populations was demonstrated by the Cap 'n Hooks Fly Fishing Club on the Saugeen River where their stretch was accessible to the individual for a nominal day-user fee. Of all of these, the Trout Unlimited catch-and-release no kill program had probably the better scientific approach in that at yearly intervals electro-fishing surveys occurred, enabling a more informed judgement to effect management decisions. Their results did indeed indicate that under a

catch-and-release no kill program fish size distributions improved, although after two years such dramatic number increases among all sizes category were not as significant as in the prior years.

Several fishing lodge operations in Canada's territories have promoted both mandatory and voluntary catch-and-release programs in an effort to ensure the natural reproduction of their trophy species. In fact, a Winnipeg-based taxidermy company now offers a unique service whereby they will reproduce an exact artificial replica of a released fish from a colour photograph and girth/length measurements. Only the angler actually knows the difference and can take immense pleasure in displaying a prize trophy mount of a fish which is still living and reproducing in the wild. This is a very real alternative for our northern fisheries where the growth of individual fish occurs at a much slower rate, and severe depletion of stocks is a constant factor which impacts highly upon the future of the sport fishing tourism industry.

Since the early 1970s, catch-and-release regulations of varying designs have been introduced throughout the continental United States. It has become an acceptable policy of the United States National Park Service in almost all national parks, and various state agencies have undertaken catch-and-release studies on their sport fisheries.

Cutthroat Trout Response to Catch-and-Release Regulations

Of particular interest to this study is how cutthroat trout populations have reacted to the implementation of catch-and-release regulations. This review is included here to give the reader a perspective of where the biological rationale comes from for the introduction of the catch-and-release regulation in Alberta and why it is being applied in particular on the North Ram River.

For the cutthroat trout, Yellowstone National Park results have the most recognition, yet in Idaho, a series of studies have been done on Kelly Creek by various authors (Ball 1971; Hogander et al. 1974; Johnson and Bjornn 1978), which documented changes over time. Lewynsky and Bjornn (1983) also examined an Idaho cutthroat fishery. In Montana, Peters

(1983) looked at the Rock Creek Management Survey results.

Jones et al. (1982) reported on the status of the catch-and-release fishery on the Yellowstone River which has been managed under catch-and-release since 1973. A 14.0 km stretch under catch-and-release was split into two distinct sections, each restricted to lures and flies only with no bait allowed. "Average size of cutthroat trout increased from an average of 14.5 inches in 1973 to a record of 15.4 inches (392 mm)."(Jones et al. 1982:82). Further verification by electro-fishing methods was found.

> Length frequency analysis of cutthroat trout captured in the spawning run at LeHardy's Rapids reveals a definite shift towards larger trout .... Length frequency and mean length of cutthroat landed by anglers also indicates a substantial increase in larger trout (Jones et al. 1982:83).

Also there was supportive evidence that mortality was even lower than in other studies. Tentative results showed

> that mortality may be less than 0.05% on a per capture basis, or 3% of the total population .... Comparison of total landings for the upper portion of the catch and release section (123,800 cutthroat trout) and population estimates for the 9.8 km segment (1,750 trout per km) suggests that trout may be captured an average of seven times during the 108 day season (Jones et al. 1982:85).

It is apparent that catch-and-release regulations will generally have positive benefits to trout populations if both mortality is low and recatchability is high. Peters (1983:8) confirmed this with the cutthroat population of Rock Creek, Montana, where in the Hogback Section "the numbers increased from around 16 fish in the years 1972-78 to an average of 131 in number of fish 8.0 to 16.9 inches in length. This is a +718% change in the composite average.".

In Idaho, an extensive study of cutthroat trout in Kelly Creek has revealed dramatic results of catch-and-release management. Ball (1971) found that after only one year of catch-and-release management on Kelly Creek, little variation in the cutthroat population structure or growth occurred. However, "the anglers' catch per hour increased to six fish in 1970 .... This increase was primarily due to (1) the reduction in total fishing effort and (2) an increase in average anglers' skill because fewer young children fished in Kelly Creek."(Ball

1971:33).

Ball (1971) also noted that there was minimum mortality although there was a large, 78% improvement in the numbers of hours/cutthroat caught (and released) in 1970, from 4.8 hours down to 2.8 hours. Then Hogander, Bjornn and Petit (1974) updated the catch-and-release effects on the Kelly Creek cutthroat population. They found that there was a three- to six-fold increase in numbers since 1970. In a four year period (1969-1973) while abundance had generally risen, catch rate (cutthroat per hour) at first increased but then declined. As well, fishermen spent less time angling in order to catch a cutthroat, and there was a noticeable increase in numbers of cutthroat trout over 25 cm in length. As an example of the general mean yearly increase of about 75 mm for 1970-1973, one Kelly Creek cutthroat tagged in 1972 "was recaptured a year later one mile above the original tagging site and had grown 96 mm or 55%." (Hogander, Bjornn and Petit 1974:13).

The next study which updated the Kelly Creek cutthroat fishery response under catch-and-release regulations was done by Johnson and Bjornn (1978). From a purely biological standpoint, the program success was excellent. In an approximate five year period (1970-1975): 1) abundance increased 13 fold (1970: n=27, 1975, n=355) for all sizes of fish; 2) the size of the most abundant group increased (1970 size: 190-210 mm, 1975: 210-260 mm); 3) the abundance of cutthroat >250 mm increased (1970: 4 fish, 1975: 160 fish) and 4) the numbers of spawner-sized cutthroat trout increased (1970: fish >310 mm=1, 1975: fish >310 mm=45) (Johnson and Bjornn 1978).

The authors commented that for Kelly Creek "the increase in catch rate of cutthroat by project personnel from 0.6 cutthroat per hour in 1969 to 2.4 cutthroat/hour in 1975 indicates an improvement in the fishery for cutthroat trout with catch-and-release regulations." (Johnson and Bjornn 1978:116). They also noted that an increase in angler expertise may have only slightly affected angler catch and/or catch rates. As well, they cautioned that for conclusive results, continued catch-and-release regulations were required until 1981 and 1982, so that age II and age III fish of the 1979 year could be represented in

the data when they returned to the river. These age classes would be the offspring of those cutthroat saved by catch-and-release in 1970 who probably spawned at age VI in 1973. Thus, the full effect of catch-and-release regulations on trout abundance and age structure would be seen approximately 12 years after their implementation in 1969-1970.

Stream cutthroat trout fisheries in Alberta are not numerous; however, data were available from river systems other than the Ram River. Paetz (1957) indicated that cutthroat trout was the dominant trout species for sport fishing in the Bow and Oldman river systems. His conclusions were that of five streams studied, there was only one stream having sufficient mature spawners to maintain adequate trout production; that angling pressure (at that time) during the open season was enough to deplete the numbers of over-two-year olds, thus seriously affecting the brood stock; that at least one year, and in some instances two years of angling closure would be required to maintain minimum natural reproduction, and that rigid enforcement would be necessary for a one- or two-year fallow system to operate successfully. The most pertinent observation for the North Ram River was that

> the fish populations in the test sections show that in readily accessible streams, either a very low number or no mature females are left to reproduce by the end of an open season. In the entire study, only four fish reached the age of 4 years and none was recorded past this age. Age-at-maturity studies show that less than twenty per cent of the female trout examined were mature by the end of the third year of life. Most of the females are removed before they have spawned once and virtually none live to spawn more than once (Paetz 1957:53).

In 1975, an evaluation of Alberta's eastern slopes stream fishery management program was done by the Alberta Fish and Wildlife Division. The program continued to permit annual open seasons on large rivers while tributary streams were only open during alternate years. This was enacted on all streams in the eastern slopes, even though Paetz (1957) recognized that not all stream populations of cutthroat trout recovered after only one year of angling closure, especially those with easier angler access.

Radford (1975) reported on the Dutch Creek cutthroat trout population's response to an experimental reduction in the daily catch limit from ten to five trout. Results indicated that more anglers were successful but that this did not necessarily increase the population; but

instead the catch was redistributed among greater numbers of anglers. Biologically, no positive results were reported as far as an increase in broodstock. Individual cutthroat trout streams other than Dutch Creek were probably managed based upon the Dutch Creek results. Whether or not the individual differences between cutthroat streams, i.e. environment, angler popularity, accessibility, etc., were seriously considered was not mentioned. In all probability, the blanket method of assessing potential management success for all cutthroat trout fisheries under this program was followed because for most fisheries this did work, at least minimally. Increasing the complexity of angling regulations might not have been popular, but public feedback may have changed over time. However, the collapse of the North Ram River cutthroat trout fishery may be linked to this blanket policy. Another factor may be the series of natural spring floods as well as two serious mid-summer floods from unusual, local rain storms (i.e. four inches in one hour) which have impacted this drainage over the past years. Regardless, the fishery did collapse, and the applied catch-and-release regulation is seen as an innovative strategy to rebuild the fishery.

The catch-and-release no kill program can be expected to have positive results because the North Ram River cutthroat trout population is one of the species that is most suited for such a program and because they can be caught on light line with barbless hooks without being affected seriously by metabolic fatigue.

Assuming that the Kelly Creek cutthroat trout fishery is our nearest experimental study example, the true outcome of a catch-and-release no kill fishery on the North Ram River may not be known for close to a dozen years. However, it is highly probable that results will be fairly similar. There should be evident increases in abundance, in biomass as well as size and age distributions. Over time, the average age of the population should rise, yielding more repeat spawners in the range of three-plus years to seven-plus years of age. Of course, this forecast must be monitored closely. Close attention needs to be maintained on cutthroat trout catch-and-release no kill programs elsewhere to inform ourselves about potential results and problems.

Response of other trout species to catch-and-release regulations have been highly varied in their response. Studies concerning the response of brown trout to catch-and-release regulations have been discussed by Peters 1983, Hunt 1981, Deinstedt 1977, Graff et al. 1977, and McLaren 1970. Studies concerning rainbow trout (*Salmo gairdneri*) and their response to catch-and-release regulations include Peters 1983, Billings 1982, Burns 1977, Deinstedt 1977, Caverhill 1977 and Pettit 1977. Similar studies have been done on brook trout (*Salvelinus fontinalis*) by Hunt 1981, 1977 and 1970; Latta 1973, Shetter 1969b and Shetter and Alexander 1965.

B. A Review of Hooking Mortality and Related Issues

The premise of the catch-and-release concept is to achieve a significant reduction in the mortality of all released fish. Thus, hooking mortality studies for trout have played a crucial role in the biological acceptance of catch-and-release as a viable alternative in fishery management strategies.

There have been varied results of catch-and-release programs with other trout species which seem to indicate a differentiation between rainbow trout, brook trout and brown trout with regard to hooking mortality (Hunt 1981, 1970; Varley 1979; Alexander and Ryckman 1976; Hunsaker et al. 1970; Horak and Klein 1967; Stringer 1967; Shetter and Alexander 1966, 1965; Klein 1965, 1966). In addition, extensive experiments have revealed that a species will be affected differently according to the type of hook utilized by the angler. While the literature is rich in results for all these species and types of tackle, the intent of this section is to reaffirm a conclusion based from the literature review that the cutthroat trout is impacted the least by hooking mortality and then to review the specific effects of barbless lures and flies on the cutthroat in particular.

Although there has been wide variability in the conditions under which hooking mortality studies have been conducted on salmonids, there is a concensus that artificial flies cause less mortality than do artificial lures, which in turn cause less mortality than baited

hooks (Warner 1979; Warner 1978; Warner and Johnson 1978; Bjornn 1975a; Hunsaker, Marnell and Sharpe 1970; Shetter and Allison 1955). In summarizing the studies concerning the variability of hooking mortality, involving 9,062 fish, Wydoski (1977) stated that "lures caused about one-third (32 per cent) more mortalities than flies. In contrast, hooking mortalities caused by bait fishing were 4.1 times greater than for lures and 6.2 times greater than for flies." (Wydoski 1977:56).

Cutthroat trout mortalities have been studied by several researchers (Bjornn 1975a; Hunsaker, Marnell and Sharpe 1970; Benson and Bulkley 1963) and may be consulted in Table 1. It is interesting to note that in general, the accompanying information revealed that cutthroat trout hooking mortalities were only slightly higher with regard to the use of barbless flies or lures than from the use of barbed artificial flies (2.8% vs. 2.2% when mathematically averaged). However the results cannot be considered significant and therefore the rationale for the use of barbless hooks is not conclusive. In many situations it may be argued rightly that the advantage of using barbless hooks lies in the reduction of handling time since hook removal is easier (Roberts 1983, Pers. Comm.). Wydoski (1977:60) pointed out that "handling ... can be more important than hooking in overall mortality, [and] this factor could be an important consideration to quality angling.".

Considering the literature regarding the effect of handling fish when caught by anglers, there is a variation in results. Although it is evident that there will be an increase in the survival of fish when the angler is knowledgeable about the best method (Pettit 1977; Reingold 1975; Wedemeyer 1972).

Mortality of fish may be either initial or delayed. Studies have shown that the former is usually directly related to the hooking site and whether or not a vital organ is injured (Warner 1979, 1978; Warner and Johnson 1978). Mortalities occurring within 24 hours of being caught and released are classified as initial, while those occurring after 24 hours are classified as delayed. Various researchers (Falk et al. 1974; Mason and Hunt 1967; Stringer 1967; Bouck and Ball 1966; Parker et al. 1959; Parker and Black 1959; Black et al. 1959; Black

Table 1. Hooking Mortalities of *Salmo clarkii* (Adapted from Wydoski 1977:43-87).

Hooking Mortality (%)	Number of Fish	H_2O Temperature	Location
*48.5	16	4.5-17°C	Wyoming
**2.9	102	3-9.5°C	Wyoming
6.5	200	7.5-13°C	Wyoming
4.0	50	14.5-16.5°C	Wyoming
2.7	113	4.5-16.75°C	Wyoming
0.7	not available	10°C	Wyoming
21.3	not available	17°C	Wyoming
2.4	209	7°C	Idaho
***4.0	75	4.5-16.75°C	Wyoming
0.4	256	7°C	Idaho
****6.0	100	4.5-16.75°C	Wyoming
1.2	164	7°C	Idaho
*****3.3	60	4.5-16.75°C	Wyoming
0.8	264	7°C	Idaho

* Caught and played on bait with barbed hooks.

** Caught and played on artificial lures with barbed, treble hooks.

*** Caught and played on artificial flies with barbed hooks.

**** Caught and played on artificial lures with barbless hooks.

***** Caught and played on artificial flies with barbless hooks.

1959) have examined the response of fish to stress, hyperactivity and muscular fatigue under varying conditions.

Klein (1965) and Stringer (1967) both found that the majority of rainbow trout caught on different types of tackle with hook damage to a vital organ died within 24 hours. Single hook use led to a greater mortality rate within 48 hours than did treble hook use although with the latter, mortalities continued to occur afterwards. It was concluded that lures with single hooks were taken further into the fish's mouth causing a higher incidence of vital organ damage.

While many studies have looked at delayed mortalities of fish, it is important to consider the particular species and its environment when trying to deduce conceivable implications for the actual species being examined. For example since North Ram River cutthroat trout are now wild fish, it may not be wise to conclude that study results for stocked salmonids will apply equally when considering hooking mortalities. Even wild and hatchery trout will differ, as it has been shown that wild trout recover faster from hooking and playing.

Bouck and Ball (1966) studied rainbow trout from a fish farm in a laboratory situation and found a six inch fish played to exhaustion usually dies when released. However, with wild rainbow trout in a stream setting, the probable playing time for yearlings of that size would be under one minute which would thus eliminate the exhaustion factor in a natural setting.

A better indicator for wild rainbow trout mortalities from angling was provided by Black (1957a) who studied Kamloops trout and the alterations in their blood level of lactic acid following muscular activity. While he subjected yearlings and two-year olds to 15 minutes of vigorous exercise and then examined them, this is a very unlikely time duration for an angler to play fish of these ages. Since two-year olds are approximately between six and nine inches, the probable playing time would be no greater than one-third of 15 minutes or five (5) minutes. However, he reported

> the blood level of lactic acid in yearlings increased from the unexercised level of 16 mg % to 100 mg % and then continued to increase still further during the first 2 hours of recovery to 170 mg % to subside in 4 to 6 hours toward the pre-exercise level. Similar changes occurred in 2 year olds, but the levels were lower in all cases and the time course was slower (Black 1957a:117).

Black et al. (1959) examined changes in pH, carbonate and lactate of the blood in Kamloops rainbow trout during and following severe muscular activity and reported that

> the course of the blood lactate level ... is typical for other salmonoids .... The average resting value for 1957 was 7.2±1.34 mg % .... This increased to 71.1±8.41 mg % following 15 minutes exercise. There was a further increase in the lactate level during the first two hours of the recovery period (approximately 120 mg %) followed by a decline to near resting levels which may be reached between the 6th and 8th hour of recovery (Black et al. 1959:393).

It was interesting to note that the peak level of blood lactate was relatively low at approximately 120 mg % in comparison to Black (1957a), and that as a result of exercise alone, no mortalities were observed. Black (1957a, 1957b) noted that there were no significant ensuing mortalities observed from severe fatigue with either rainbow or lake trout (*Salvelinus namaycush* (Walbaum)).

This was reinforced with pacific salmon (*Oncorhynchus*) in a study by Black (1957c:444) where the author stated that "for fish which died, blood lactate rose until death. Survival occurred either when blood lactate did not reach critical levels (above 125 mg %) or reached a critical level and then subsided.". In comparison with trout mortality blood lactate levels, it can be seen that there was not much of a difference in the critical peak levels of rainbow trout and pacific salmon. However, there is a safety mechanism in pacific salmon to prevent blood lactate from building to critical levels, which is the fact that once these salmon are about to begin their extensive up-stream migration in freshwater, they stop feeding.

> The slower mobilization of stored fats and non-essential proteins may act as an effective 'pacer', preventing disorientation following fatigue, a condition which might lead to passive displacement downstream, thus net loss and needless expenditure of energy (Parker et al. 1959:443).

For chinook salmon (*O. tshawytscha* (Walbaum)), the high mean value of lactic acid blood levels during the first three hours from hooking was established at 180 % mg (Parker and Black 1959) after less than 10 minutes of playing time. This result was even higher than

for the pacific salmon and the Kamloops rainbow trout. Accordingly, it would seem that cutthroat trout would approximate the same general lactic acid buildup from exercise as the Kamloops rainbow trout. But again, it must be remembered that the Kamloops trout are lake residents while the cutthroat trout being considered here are stream and river residents, so this is more of a guide than a fact.

Wydoski (1977:69) did measure blood lactate levels in planted cutthroat in a Utah reservoir after they were played for different time lengths and found that "blood lactate increased to about 75 mg/100 ml of blood in 5 minutes of playing time, continued to increase (to nearly 120 mg/100 ml) after one hour of recovery time, and then returned to nearly normal values by 24 hours of recovery.". While not being directly comparable to stream dwelling, wild cutthroat trout, these studies do show that wild-stream-dwelling cutthroat trout would not approach the critical blood lactate levels even if they were unnecessarily subjected to an extensive playing time of five minutes. Therefore angling induced exercise would probably not seriously affect the mortality of cutthroat trout caught and released in the North Ram River.

Another source of delayed mortality has been identified to be sublethal hooking stress. Brett (1958:68) arrived at an understanding of stress as "a state produced by any environmental factor which extends the normal adaptive responses of an animal, or which disturbs the normal functioning to such an extent that the chances of survival are significantly reduced.".

It may be concluded that the overall cumulative effects of angling on fish populations may eventually cause some mortalities. The catching and playing of individuals may contribute to eventual death, but definitely, for wild, stream-dwelling cutthroat trout, these actions are not usually the direct cause of death. Accordingly this review of the most harmful factors affecting fish (e.g. playing time and terminal tackle usage), demonstrates three major points as far as catch-and-release programs for cutthroat trout are concerned:

1. Given appropriate restrictions on terminal tackle allowed, individuals of this species will

probably recoup from the metabolic fatigue of exercise from being played more quickly than would individuals of other trout species.

2. Wild cuthroat trout should have less delayed mortality and a faster recovery rate than would a stocked variety.

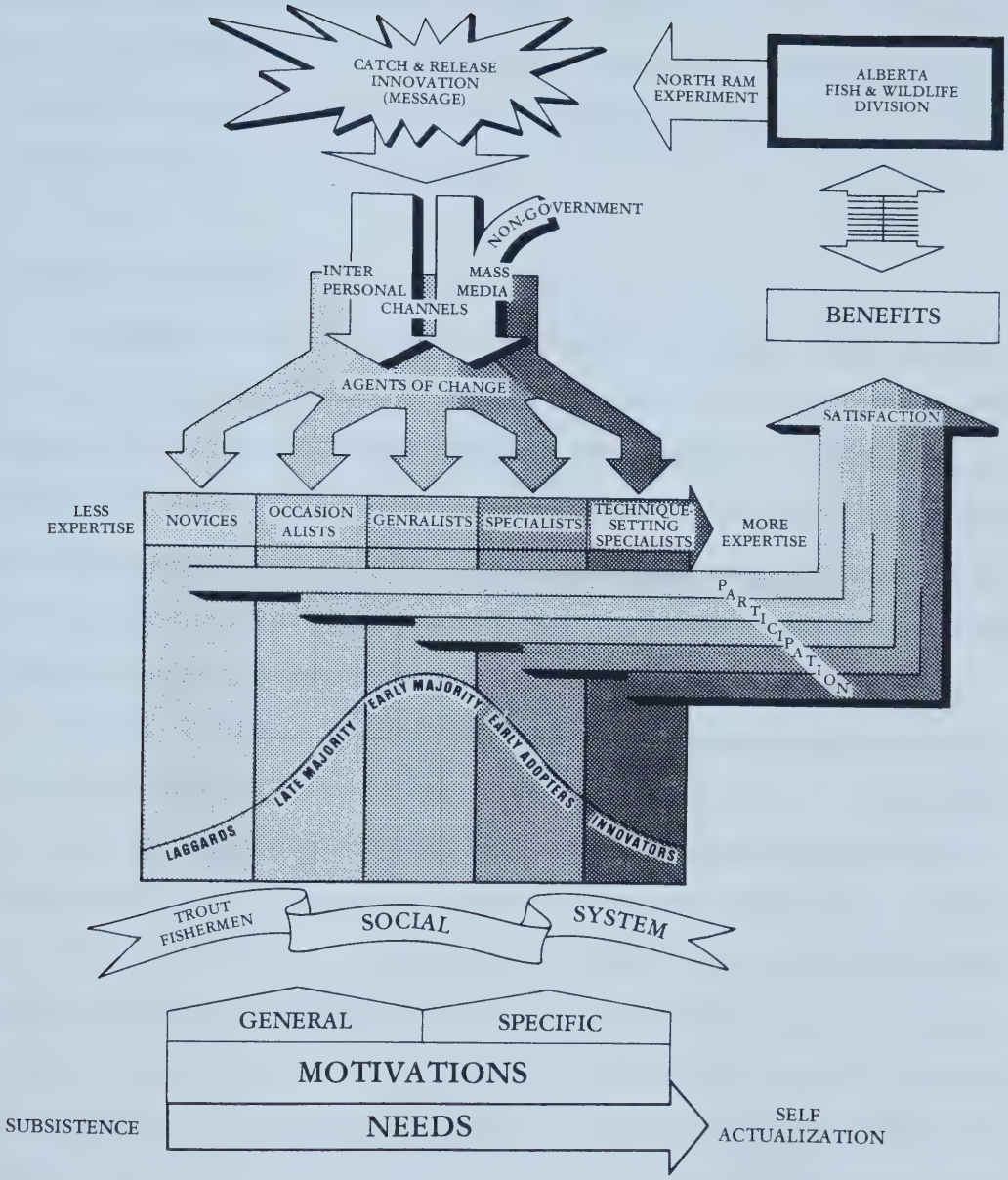
3. Environmental factors of stress need to be monitored and possibly manipulated so that future potentially significant mortalities are reduced whenever possible.

IV. UNDERSTANDING TROUT ANGLERS: TOWARD THE DEVELOPMENT OF DESCRIPTIVE ANGLER PROFILES RELEVANT TO CATCH-AND-RELEASE PROGRAMS

A. Introduction

The literature dealing with why individuals participate in outdoor recreational activities is extensive. Research efforts have attempted to look at motivations, preferences, perceptions and characteristics of different outdoor recreational users in order to assist in the development of a useful delivery system of optimal recreational opportunities (Kershner and Van Kirk 1984; Kennedy and Brown 1976; Hendee 1974; Hendee et al. 1973; Hoaglund 1973). The very diverse nature of these studies tends to overwhelm the reader until some sort of classification or conceptual categorization is brought into place. It is with the intention of introducing a hypothetical model (Figure 3), that the following factors have partially been selected for discussion. This model is only a conceptual forecast of what may or may not prove to be a guiding framework for future research endeavours that consider the integration of several social science theories. Specifically, there may be a relationship between individuals' developmental progression stages within a chosen leisure pursuit and how new and/or more restrictive regulations are both perceived and accepted by the social system. However this research will only address a portion of this model, in particular the acceptance of a new restrictive regulation by individuals composing terminal tackle typologies of the trout angling social system in Alberta.

The following literature review will address the basic descriptive characteristics that compose the angler profiles considered within the context of this study. These profiles have been devised to test the validity of measuring certain angler characteristics for use in understanding trout angler response to the introduction and imposition of preventive sport fishery policies such as catch-and-release, no kill. As well, the nature of the data should assist in defining one of the experiential opportunities available to trout anglers among the spectrum



CONCEPTUAL INTEGRATION MODEL OF THE TROUT FISHERMEN SOCIAL SYSTEM:

ADOPTION OF THE CATCH-AND-RELEASE INNOVATION AND ITS RELATIONSHIP WITH AN ANGLER'S DEVELOPMENTAL PROGRESSION LEVEL.

Figure 3.

of quality fishing experiences within the province. The potential exists for anglers to have the opportunity to select an optimal fishing experience from among several regionally available alternate sport fisheries. Such information may be depicted in a publication about both qualitative and quantitative aspects of the catch, as well as environmental (e.g. water quality) and social attributes (i.e. facilities and services).

B. Experiential Components of Trout Angling

Motivations of anglers have been examined by several authors, revealing the complex diversity of what people seek from their angling involvement (Hicks et al. 1983; Hooton 1982; Dunning 1978; Stroud 1977; Kennedy and Brown 1976; Knopf et al. 1973; Moeller and Engelken 1972). These research efforts included temporary escape, achievement, exploration, experiencing natural settings, being with friends and family, learning about nature, having fun and the challenge of the catch. The consensus was that fisheries management requires the integration of many factors associated with fishing, not just the harvest of fish.

Talhelm (1973) did a study of recreational resources on the premise that different recreation resources have different attributes of diverse importance to users. He contended that "nearly any recreation resource... can be characterized by enumerating the attributes of the associated recreation experience that users expect." (Talhelm 1973:21). When analyzing trout fishermen, he found that the most important attributes defining the character of trout angling in the southern Appalachians were catch rate, stream size and regulations. Ditton et al. (1978) segmented differing perspectives related to the 'catch fish' motive and concluded that while catching fish is an important motive, it is not the sole motive, that catching fish does not always mean catching a lot of fish and that qualitative aspects of the catch (excitement, unique experience, big fish, challenging fish and adventure items) are more important than quantitative aspects of the catch (a lot of fish, assurance of catch, species preference). All of these have substantial implications for catch-and-release regulations.

The motivations for recreation participation have been described as being either of a general or a specific nature. Every individual recreationist has been a novice and at that stage would have defined his participation rationale in general terms. At that time, it probably would have made little difference as to which activity he selected, except that the environmental setting and interaction with others would have fulfilled his own preconceived expectations or those expectations that he had formed in the company of others. This is the basic premise upon which the recreation substitutability concept was introduced as an alternative management method (Christensen and Yoesting 1977). Vaske and Donnelly (1982) have since examined the substitutability concept from a different perspective, that of a user selecting a different resource location if the original site is unavailable, instead of choosing a different activity. However, this would be more logical for a recreationist who does not want to do some other activity since he enjoys the specific nature of the originally selected outdoor pursuit because of previous personal experience. "Because planners and managers ... actually allocate land and manipulate settings to increase the probability that certain experiences will be realized, it is important that they know which types of settings are perceived by recreationists to deliver different desired experiences." (Brown and Ross 1982:105).

To illustrate the above contention, Buchanan et al. (1982:62) discussed the relevance of anglers' resource orientation in relation to their desire for the 'wild' experience.

> ...'Wild fishermen' value pristine surroundings above all other facets of the fishing experience.... If wild fishery sites are to continue to provide unique benefits to fishermen, appropriate procedures should be followed to ensure that these areas retain their pristine quality.... The wild fishermen's need to escape both the family and physical pressures is an element of the fishing experience that also deserves management's attention. Given the importance of these benefits to wild fishermen, the adoption of management strategies capable of keeping fishing pressure at low levels at the wild areas may be necessary. A variety of options such as reducing creel limits or establishing catch-and-release policies might be considered, although conceivably the wild management policy of non-stocking may act as sufficient control.

To Bryan (1979), it was apparent that each fisherman type had differences as to their preferences for the setting of fishing experiences. Occasionalists had no real particular preference for lakes or streams, but emphasized the importance of ease of access to the

fishery. Generalists seemed to equally prefer lakes, and large and small streams while technique specialists (i.e. fly fishermen) definitely preferred streams to lakes although they were evenly split between small and large streams. However, Bryan (1979) found that technique-setting specialists sought out smaller streams more than larger ones and were seeking the special attributes associated with their fly fishing specialization (e.g. spring or glacier fed streams).

> In order to develop a psychologically meaningful categorization of leisure activities, three things should be taken into account simultaneously: the activities, the needs they satisfy and individual differences in perceptions of activities and their need-satisfying properties (London et al. 1977:255).

Logically contending that motivations are based upon needs, London et al. (1977) found that users viewed activities in terms of three need dimensions: liking, feedback and positive interpersonal involvement. Various research efforts have looked at why people choose to fish which can be linked to these need dimensions. Gordon et al. (1969) found that there was a willingness to pay more in order to ensure certain fisheries were maintained and that to attain the best experiences a range of different types of fisheries could be developed on a regional basis. Support for providing alternative experiences for the different preferences and expectations of recreationists can be found in several studies (Hicks et al. 1983; Ragheb 1980; Field 1974; Hendee 1974; Stankey et al. 1973; Potter et al. 1973). Essentially, they all follow the rationale put forth by Hendee (1974) in his work on the multiple satisfaction approach to game management. He defined satisfactions as being more specific, immediately gratifying pleasures (i.e. companionship, socialibility, physical exercise, the display of skills) and benefits as the more general and improved long term conditions which result from one or more satisfactions. "Success is an important hunting satisfaction but it is only one of many. Although game is the obvious thing all hunters seek, their more important 'harvest' may be the other satisfactions they receive and the human benefits to which those lead."(Hendee 1974:107).

Potter et al. (1973) asserted that while the harvest of game contributed to the satisfaction of almost all hunters, a majority cited other satisfactions as more important. Therefore, it was recommended that for quality experiences in consumptive wildlife activities, managers need to ensure reasonable probabilities of success as well as a full continuum of opportunities for other directly related satisfactions dependent upon hunting and/or fishing for their realization.

The concerns of trout fishermen about management vary according to the resource setting and the angling preference. Topics of concern revealed by Bryan (1979) include stocking policies, accessibility factors, habitat management, the retention of wild trout stocks and size of fish available. In the description of those anglers actively supporting wild trout management, they are depicted as being in favour of catch-and-release policies on certain streams where the health of the trout population is in question.

Buchanan et al. (1982) found that the management orientation of anglers is dependent upon their perceived benefits of what they desire through angling. Accordingly, they found some benefits were positively related to wild fishing areas while other benefits were negatively related to such areas. Similar results were revealed for trophy fishing areas. However, "regardless of the way fisheries were managed, fishermen consistently perceived more important benefits resulting from experiencing nature, escaping physical pressure (e.g. noise, crowding) and experiencing physical rest than from catching fish." (Buchanan et al. 1982:61).

Furthermore, Buchanan et al. (1982:61) contended that "... the high rankings for trophy, wild and harvest fishing experiences..." show promise for management agencies when considering the result of segmenting user groups. The most evident delineation of management preference by any of the user groups considered was found to be made by anglers seeking the 'harvest' oriented angling experience.

Manfredo and Anderson (1982) found that fly anglers were more non-consumptive oriented compared to lure and bait anglers and were also more skill oriented. More than half

of each of the angler subtypes that they defined felt that restrictions on bag limits should be implemented for wild trout protection. Stream anglers in particular were in favour of increasing the legal size of trout and "compared to others, fly and lure/stream anglers were less supportive of increased hatchery production and more interested in decreased bag limits for lakes and streams and in increased emphasis of wild trout." (Manfredo and Anderson 1982:66).

Another research team which contributed extensively to the data available on the analysis of angler preferences was Schoolmaster and Frazier (1985). They made general statements about the causal linkages that they found for each of their considered management options. A few are condensed and included here for information purposes.

1. Preferences for creating a shorter catch-and-release section were explained by age, education, first visit and observed conflict (among bank anglers and float anglers).
2. A preference for increasing the possession limit was supported by anglers with lower education levels making their first fishing visit.
3. Emphasizing a fish stocking program suggested the need for increased numbers of fish to enhance catch opportunities. Thus, the causal linkages are logical: Those who feel that there are inadequate numbers of fish in the river support this action.

Schoolmaster and Frazier (1985) results supported the importance of formulating a causal theory that allows for the exploration of both direct and intervening influences between variables of an intrapersonal and/or environmental nature which might impact how an angler approaches management actions. Their major predictive variables which they recommended should be further researched were:

- whether the angler was on a first trip or return visit to the fishery (user experience in terms of continuity),
- angler education,
- angler age,
- angler perceived carrying capacity of the fishery.

And they also asserted that "of particular note is the reinforcement of a majority of Bryan's (1977) theory of recreational specialization and trout fishing." (Schoolmaster and Frazier 1985:339).

Moeller and Engelken (1972:1257) looked at angler preferences of fish size and numbers and linked them to how the fisheries are utilized. They found that

1. Fishermen with less fishing experience placed more importance on the size of fish caught than their counterparts.
2. The number of fish caught was more important to younger fishermen.

It is interesting to note that the amount of previous fishing experience and the age of the anglers seemed to also affect angler preferences for certain sizes and numbers of fish.

Gordon et al. (1969) discovered that a significant majority of anglers preferred a catch of fewer but larger trout and recommended the stocking of a few select fisheries with bigger fish and instituting a smaller bag limit. Hicks et al. (1983) interviewed trout park anglers in Missouri and found that their ordering of important events was to catch at least one fish, then more fish, then bigger fish. However, the authors cautioned against providing an imbalance of quantitative versus qualitative aspects in trying to satisfy such anglers, as a proportionate provision of all options needed to be present for the variation among angler preferences. Klein (1972) found some support for maintaining a trout fishery which provides relatively large fish in select lakes in Colorado even though the catch per man hour is only 0.2 or more. Kershner and Van Kirk (1984) found that anglers from 14 to 25 years and over 56 years thought that fish for food was important.

Another study also contended that the impact of angler fishing orientation as an element of sport fishery management is apparent, as the following findings of Hendee, Clark and Dailey (1977:22) illustrated.

1. For those 'ardent' fishermen who go to the lakes primarily to fish and fish primarily to catch fish -- manipulating the fishery would probably change their behavior.
2. For those 'incidental' fishermen who visit high mountain lakes primarily for reasons other than fishing, even though they fish, or who fish primarily for reasons other than to catch fish, a change in the fishery is less likely to have an effect.

It was Hendee, Clark and Dailey's (1977) belief that the majority of fishermen are incidental fishermen and that fishery manipulation as well as other factors, should be considered by resource planners and managers. It is definitely noticeable that a distinction has been made as to the degree of specialization by anglers in their analysis. Radford (1980) referred to Albertan anglers fishing high mountain lakes as being strongly motivated just toward fishing.

An angler's orientation toward fishing has been theorized to change with increasing experience (Bryan 1979). As more experience is gained an individual's perception of fishing (supposedly) develops from the simple to the complex (Bryan 1979). Schweibert (1978) stated that with increasing specialization an angler will seek more to challenge both his abilities and himself.

Schreyer (1982) was interested in whether or not experience affected expectations for recreation participation. He theorized that it was possible that the amount of experience held by an individual (which in turn related to his information level) might strongly affect the way he would evaluate his recreation participation. It was found that people having different experience levels were not really that different in their desired outcomes, but experienced users tended to describe their outcomes more specifically. Qualitatively, it was found that regardless of the experience level of the user, participation tended to be fairly similar although it cannot be assumed that "generally stated outcomes represent similar subjective psychological experiences." (Schreyer 1982:158). Specificity is described as perhaps being a perception of differing recreation environmental attributes which may be related to a diversity of responses to managerial strategies, the provision of services and amenities and how other user numbers and their distribution are controlled. Schreyer (1982) pointed out that increasing experience caused an expansion of awareness of the environment and its varying conditions. "In this sense, the concept of experience may represent a complex developmental process of cognitive structures pertaining to environment and activity." (Schreyer 1982:158).

Using 'desired outcomes' could be viewed more as indicators of the priorization of participation features required to enhance user satisfaction levels rather than a satisfaction assessment criterion. With participation over time a recreationist may become more interested in the details and specifics of the activity itself and may choose to develop his interest, if indeed it appeals to and satisfies the particular needs desired from recreation participation (Bryan 1979, Kelly 1974).

Bryan (1979) stated that species preference did not necessarily indicate a certain level of individual specialization, but it still could assist in defining the angler's orientation to his sport. He further theorized that an individual would have particular preferences for equipment which change from the basic (spinning or spin-casting) equipment to the complex (fly fishing) tackle at the high end of the recreational specialization continuum. "Occasional fishermen are more likely than generalists not to have particular preferences ..., while generalists are evenly divided ... in preferring spinning or spin-casting methods. Specialist fishermen, by definition, prefer fly-fishing tackle." (Bryan 1977:178).

Catton (1969), identified the appeal of fly fishing as the one angling technique which maintained the uncertainties of the goal outcome. He equated the progression of an angler's use of equipment with the theory postulated by Emerson (1968) when motivation toward a goal is highest if the goal outcome is uncertain. In effect, the pleasure of fly fishing lies less in the achieved solution than in the problem-solving process. "The fly fisherman is apparently less motivated by the trout he occasionally catches than by the uncertainty as to whether he can catch any fish with a line of less tensile strength than the fish's weight." (La Piere 1954:132).

This line of rationale would seem to fit well within the previously discussed literature on the tendency for more complex and specific motivations to develop later in an angler's development. Fly fishing would appear to meet more specific angler needs than the more generalized needs of the novice fisherman. Consult Table 2 for a breakdown of trout fishing reasons, as presented in Manfredo and Anderson (1982), with regard to technique use.

Table 2. Reasons for Fishing for Trout.

Reason	Fly	Lure/ stream	Bait/ stream	Lure/ lake	Bait/ lake
To enjoy the outdoors	67	72	77	72	66
Fishing as a sport	62	57	62	65	59
To fish for food[1]	30	41	44	45	47
To get away from people[1]	34	30	31	18	21
For family experience[1]	22	23	20	29	31
Testing skills[1]	38	25	21	19	21
To be with friends	15	14	16	20	18
To catch large fish	4	9	4	4	5
To catch wild fish[1]	4	5	2	2	1
To catch lots of fish	2	3	2	3	2

[1] All tests were made at $p > 0.05$ using Chi square. (The source of the data was the Preference Survey of Oregon Resident Anglers, Lowry 1978).

(*In*: Manfredo, M.J. and D.H. Anderson 1982:65).

Jackson et al. (1979) and Bryan (1979) developed separate developmental continuums for hunters and fishermen that incorporated nonconsumptive elements within consumptive recreational behaviours. They both described participation in terms of an angler's developmental stages of growth reflecting his/her interest, commitment and value systems. While they theorized that most consumptive wildlife recreationists tended to proceed through these stages from a generalized to a more specialized orientation, they also recognized that variations exist. Kelly (1974:192) also intimated that the same activity over time and at different times, may have different social meanings and role relations to the individual. He further clarified this process by stating that "skills, attitudes, relationships, roles and resources develop through the years. Activities are learned, expanded, dropped, relearned, etc., depending on the circumstances.". These variations are dependent upon the angler's level of needs, the angler's reference group and the initial introductory experience. Jackson et al. (1979) underscored the importance of the participant group to the individual consumptive sportsman attesting that a hunter changes his way of hunting dependent upon with whom he is hunting (i.e. peers versus family). As well, Schweibert (1978), pointed out the effect of the tutor on the beginner, since most novices are introduced to the sport of fishing by a more experienced angler. It is conceivable that some of the stages of development may be skipped if the tutor has already progressed to a higher level.

> The typical odyssey we travel in learning to fish is a gradual and satisfying journey. It is slow evolution from beginner to expert, and it involves a subtle metamorphosis from fisherman into angler. However, it is not merely the refinements of fishing and our fish-catching skills that occupy this transformation. It is also a remarkable evolution in attitudes. The full metamorphosis is complete when a man realizes that his fishing skills have been so developed that he can deplete his own sport. (Schweibert 1978:1558)

However, some anglers never progress beyond a certain stage, and in fact, may regress in other situations. But for those anglers who have long been able to fill their creel because of their highly developed skills, the aspect of displaying prowess through the number of fish in their creel no longer retains its original importance. To these sophisticated anglers, according to Schweibert (1978), the highest achievement was the number of fish that were released for

another day. While on occasion these highly specialized anglers might have kept a fish because of a specific request or because of excessive damage to the fish in landing it, "the really skilled fisherman loves his sport far too much to spoil it with wanton killing." (Schweibert 1978:1559). As well, this author pointed out that for those anglers who went to the trouble of travelling hundreds of miles to fish a trout stream, spent leisure time and money, the price per pound of fish was incredibly high, so in investment terms, it was apparent that such commitment would have been for the sport of trout fishing and not for the kill of the fish caught.

The conceptual stages of fishermen development proposed by Bryan (1979), go from occasionalist to specialist, were not defined as mutually exclusive, since there was usually overlap occurring from one stage to the next because of the gradual nature of belief/value and behavioural changes within the individual (see Table 3). In the words of Bryan (1977:175), this continuum of behaviour went: "from the general to the particular reflected by equipment and skills used in the sport and activity setting preferences. At one end of the continuum is the person who devotes or limits interest to some special branch of the sport. At the other end is the person who has more general recreational interests.".

He further clarified that the progression of the individual angler was a 'cumulative response' when the individual went from rudimentary tackle in his earlier participation to lures cast with spin-cast or spinning tackle at a later stage, and finally later progressed to fly fishing equipment. Bryan (1979) found that all four of his theorized angler types reported a cumulative response in the majority of cases (technique-setting specialists, 76%; technique specialists, 66%; generalists, 65%; and occasionalists, 60%).

It was interesting to see that Harry et al. (1972), in advocating sociological criteria for the allocation of outdoor recreation resources, argued that the appropriate criterion was the degree of specificity of motives held by users. Thus, the priority of fishery resource allocation is to provide for fishermen with specific motives first since they have fewer resource alternatives in which to derive satisfaction from participation. Those wildlife recreationists

Table 3. Degree of Angling Specialization and Fishermen Characteristics

Degree of Specialization	Fishing Orientation	Resource Orientation	Social Setting
	Equipment	Management Philosophy	Leisure Orientation
Occasional Fishermen	Catching a fish, any fish on any tackle available.	Any water containing fish. Ease of access to water.	Fishing with family. Seldom take vacations.
Generalists	Catching a limit of trout on spinning or spincasting tackle.	Lakes, larger free-stone streams. Stocking to supplement fish reproduced in streams.	Fishing with peers. Take short vacations within region.
Technique Specialists	Catching large fish on specialized equipment (fly-tackle).	Prefer stream fishing to lake. Harvesting policy to enhance fish size.	Fishing with peers. Take extended fishing vacations.
Technique-Setting Specialists	Catching fish under exacting conditions - on spring streams with specialized equipment (fly-tackle).	Limestone spring streams. Habitat management, preservation of natural setting.	Fishing with fellow specialists (a reference group). May center lives around sport.

(Bryan 1977:185).

motivated by more general motives can satisfy their needs because there are more available activities and situations for their use. Thus, this logic would indicate that the more specialized anglers should be considered in the resource allocation process first in order to optimize the total human benefits available from outdoor recreation resources. Bryan (1977:186) echoed this and further defined this relationship.

> The values attendant to specialization are inextricably linked to the properties of the resource on which the sport is practiced. As level of angling specialization increases, resource dependency increases. What appeals to the specialist is a resource setting allowing for predictability and manipulation, a degree of control so as to be able to determine the difference between luck and skill.

The effect of an individual's introduction to leisure sport participation has been theorized to play an important role in his/her recreation involvement throughout life. Dottavio et al. (1980) suggested a need to look at the structures of power, leadership patterns, communication flows and the interrelationships of friends within groups. For example, Hooton (1982) in a study of Vancouver Island steelhead anglers, determined that members of the Steelhead Society of British Columbia averaged more days fished, more fish released and a higher total catch than members of other angling clubs or non-club members. All angling club members were found to have more years of fishing experience and a higher number of steelhead kept than non-members As well, Steelhead Society members were definitely in favour of more management information (81.8%) compared to members of other clubs (64.8%) and non-club anglers (44.6%). In general, he concluded that "Among Vancouver Island steelheaders, organized anglers are, on average, more experienced, more active, more successful, more interested, and likely because of all these, better informed, and more opinionated than unorganized anglers." (Hooton 1982:48).

Field and O'Leary (1973) identified three possible 'social action systems' consisting of family, friends and family-friendship groups. Cockrell and McLaughlin (1982) studied how social influences might affect recreational behaviours. They argued that there are three types of personal beliefs: descriptive, inferential and informational. While the former two are internalized within the individual, the latter is directly influenced by the message source. It is

through the individual's development of informational beliefs that the most control can be realized by fishery managers, in that it is a direct linkage. However, this is most effective for influencing novice or beginning anglers. For those individuals who have already formed their beliefs regarding fishing, the fishery manager must try to indirectly influence behaviours by opening up communication links from within the anglers' social action systems. This is difficult and time consuming, but of value. The dissemination of information must occur throughout the target social system since individuals are usually introduced to fishing by others who have already developed an interest through their previous angling participation.

Kelly (1974) confirmed Burch's (1969) theory of the salience of the personal communities of immediate associates which underlined the contention that sport fishermen gain their skills, experience, knowledge, code of ethics and beliefs through the socialization process. Younger individuals related primarily through their families, school and peers, while adults interacted more so with work associates and peers as well as occasionally through interest and community groups (Kelly 1974).

Vaske et al. (1982) pointed out some interesting associations between consumptive activity satisfactions and the impact of the individual participant's social action systems, which may shed light on the provision of multiple satisfaction, quality angling experiences. They asserted that the importance of the consumable commodity was reinforced by the individual's reference group. Since the traditional goal of angling has been to prove one's prowess in terms of the catch, the angler's success is equated in terms of the number, size and type of fish caught. Even if other elements of the experience were more valued by the angler, he would still describe his experience in terms of the creel in order to meet the expectations of significant others (Vaske et al. 1982). While this is probably still true in most cases, there may be a changing social perspective (a higher environmental conscience and appreciation of ecological processes) due to a better educated outdoor recreational user public which perceives that fishing can also be appreciative-symbolic in nature.

Robertson (1982) tested the contention that wilderness behaviour can be improved through educational efforts by a resource agency. Through a multiple regression analysis, Robertson (1982) found that of five variables (knowledge, attitude, education, age and primitive camping experience) the contribution of user knowledge was far greater than any of the others, explaining 35% of the variance in visitor behaviour. Accordingly, if users are made aware of recommended conduct, then they would tend to act in congruence with those recommendations. Robertson (1982) recommended that educational efforts be directed toward all wilderness user subgroups and that resource managers provide diverse resource areas to complement the broad spectrum of wilderness users.

Dahlgren et al. (1977) also examined the effect that user wildlife knowledge had on their behaviour and attitudes towards resource issues and found some intriguing results, such as the following:

- experienced hunters had higher knowledge scores than non-hunters.
- rural-raised people had higher knowledge scores than city-raised people.

They also asserted that as people aged, they gained in wildlife knowledge, and that readership of literature related to natural resources increases with the amount of education that a person attains. Finally, Dahlgren et al. (1979) contended that those with high knowledge of wildlife and high readership were generally for hunting and had more organizational and political involvements.

C. Summation and Relevance to Catch-and-Release Acceptance

The description of fishermen characteristics such as socio-demographics, information sources, knowledge and participation patterns will contribute to the formulation of angler profiles for terminal tackle typologies which may be linked to their expectations, motivations and beliefs toward their sport. For the purpose of this study the data has been discussed in order to ensure a better comprehension of the variations within the participant population. When the varying responses of the subsamples are examined and compared regarding the

differences in their evaluation of the innovative catch-and-release program, adequate profile characteristics will be available to enable the design of successful marketing strategies to communicate the value of this preventive management policy as one of many viable alternatives within a spectrum of quality sport fishing experiential opportunities.

The following chapter will address the pertinent aspects of the related literature dealing with the adoption/diffusion process of the innovative catch-and-release trout management program as it applies to the Alberta situation. While the material covered is sufficient for this exploratory examination of the relevance of this social science theory, it does not presume to be an exhaustive review. Rather the intent is to demonstrate the need to address current wildlife management problems within the context of an expanded sociological/ecological framework incorporating the effect and impact of the human dimensions of wildlife management.

V. THE CATCH-AND-RELEASE PROGRAM: AN INNOVATION TO ALBERTA ANGLERS

Indirect and direct management techniques may be used to influence or control wildlife recreationists according to the biological requirements of the affected species. Management agencies tend to use indirect methods in the attempt to control overly consumptive visitor behaviour, although from time to time direct enforcement methods are required for the conservation and sometimes preservation of both haitats and wildlife alike. Public participation programs are the norm today for our federally managed national parks system, but on a provincial level such programs can never be assured until they actually happen. The case of the North Ram River catch-and-release program demonstrates the willingness of the agency to introduce the program on an experimental basis in order to elicit the social acceptance of such a direct management strategy. In order to inform anglers of this regulation, the restrictions were detailed in the annual publication of the province's regulation guide to sport fishing as well as being presented on-site through signage. Both the concept and the method were explained for anglers intending to fish the North Ram River. The presence of such information for public consumption was also an opportunity to introduce the idea of voluntary releasing fish to the entire angling public (an indirect method), although the main focus was to ensure angler compliance with the catch-and-release regulation on the North Ram River.

The catch-and-release program is a prime example of agency concern today about the biological status of a particular wildlife species and can be defined as a preventive innovative approach to "decrease the likelihood of an unwanted occurrence." (Buchanan et al. 1986:5). The collapse and failure of the North Ram River cutthroat trout fishery was definitely unwanted by the agency. The success of the catch-and-release program is dependent now dependent upon angler compliance and overall acceptance. It has been shown that the speed with which an innovation is spread throughout a social system is dependent upon reducing the gap between the knowledge held by individuals about the innovation and their individual choice to adopt the new idea or practice (Rogers 1983). Positive public response to this

experiment could thus be acheived if information was available to anglers for increasing their overall knowledge of the reason for application and the related ramifications for anglers.

Belief development about an innovation can be measured by analyzing how the potential adopters perceive the characteristics of the innovation. These will be defined and examined in this chapter as to their utility for the catch-and-release program's continued application in Alberta. These characteristics define the persuasion process and influence the establishment of individual beliefs which in turn formulate or alter an angler's value system. It has been said that the major benefit of incorporating the innovation adoption/diffusion theory into how wildlife-activity users are managed is that it may aid in the design, implementation and evaluation of indirect human/wildlife interaction management techniques if applied to situations on a longitudinal basis (Buchanan et al. 1986). This chapter gives an overview of the adoption/diffusion process as it applies to Alberta's catch-and-release program in order to show the rationale for measuring each angler's beliefs about each of four characteristics of the catch-and-release innovation and for creating a composite scalar variable depicting its acceptance in Alberta.

A. The Diffusion-Adoption Process

Definitions and Context

One approach toward change commonly discussed in the literature regarding the introduction of an innovation into a social system applies in this situation. For the catch-and-release program in Alberta, the Fish and Wildlife Division's initiative is in the form of a 'directed contact change'. This is a planned change coming from outside of the trout fishermen social system. In this case the personnel of the Alberta Fish and Wildlife Division are representatives of a change agency, who intentionally seek to introduce the concept of catch-and-release in order to achieve goals they have defined. Such goals are expressed in regulations, brochures and in on-site signage. These media emphasize the agency's desire to improve the population structure of the sport fishery in terms of eventual

numbers and size distributins. In broad terms, the overall goal of such a program is to encourage a positive outlook by Alberta anglers on practices designed to instill the ethic of sport fishery conservation.

The catch-and-release concept is not a new one when considering its wide-spread and proven application in other places in North America, but it is new to the majority of trout anglers in Alberta. While the 'idea' aspect of this is not entirely new, in that some anglers voluntarily release fish which in their opinion should not be removed from the reproductive cycle of the population, in all probability the very thought of releasing every fish caught would not meet with easy acceptance from most anglers. Mandatory catch-and-release has an 'object' aspect which requires the proper and caring release of the fish caught on restricted types of tackle, primarily designed to improve the survival rate of fish released.

B. Characteristics of the Catch-and-Release Innovation

Rogers and Shoemaker (1971) have identified five characteristics of innovations considered by the individual in the adoption process when presented with an innovation such as the catch-and-release no kill trout management program. The individual's differentiation among the relative importance of these characteristics leads to different adoption rates.

1. **Relative advantage** - the degree to which an innovation is perceived as better than the previous practice. Since sport anglers are not homogeneous there is no real typical fisherman so a diverse range of perspectives should be expected.
2. **Compatability** - the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the receivers. A segment of anglers within our angling social system may identify with catch-and-release very readily. Specifically these individuals may be discerned as those who have had prior experience with programs elsewhere.
3. **Complexity** - the degree to which an innovation is perceived as difficult to understand and use. Since the releasing of fish is not a major new concept to most anglers (just the

release of every fish), the most complex aspect of adopting the catch-and-release program is the time spent on learning how to release fish with proper care.

4. **Trial Potential** - the degree to which an innovation may be experimented with on a limited basis. The catch-and-release program should have a high degree of trial potential associated with it through the opportunity to voluntarily release fish on all non-mandatory catch-and-release waters.
5. **Observability** - the degree to which the results of an innovation are visible to others. This is obviously limited in Alberta until the biological results are forthcoming from the North Ram River catch-and-release sport fishery. However, the apparent success of British Columbia steelhead catch-and-release programs provides a relatively close Canadian example. As well, the neighbouring American states of Idaho, Montana, to some extent Washington state, and virtually any National Park in the United States provide further opportunities of observability for Alberta anglers who are mobile or well-informed.

Communication of Innovations

Mason (1964) undertook research on the process of adopting innovations among farmers, specifically in an effort to determine what and how various sources were used. Basically, the use of all information sources - mass media, governmental, peer, and commercial, played important roles throughout the stages of the adoption process. Communication methods employed by the change agency, in this case the Alberta Fish and Wildlife Division, follow a very similar model and are of crucial importance to the adoption process of the catch-and-release innovation. For communication effectiveness, a change agency must recognize that some, but not all of these sources will be consulted by the message receivers in order to verify the evaluation decision and therefore a change in behaviour will not be instantaneous nor unanimous. The adoption of the catch-and-release program should be an interactive one among anglers in Alberta, and should also be relatively systematic in

nature.

Muth and Hendee (1980:142) summarized this process well:

> Certain individuals are sought out for information, opinions, and suggestions about many things, and it is by them that innovations are more effectively diffused throughout a social system. But only a few key people in a community have such influence.

These few key individuals have been termed 'opinion leaders' by Rogers and Shoemaker (1971:243) who defined 'opinion leadership' as "the degree to which an individual is able to influence informally other individuals' attitudes or overt behavior in a desired way with relative frequency.".

The manner and method of information exchange follows the classic multi-step flow model of communication, which basically expands upon the indirect linkages between mass media and audience through the connecting social relationships inherent in a social system such as Alberta's trout anglers.

The message source may be from either side of this linkage, and individuals may obtain their information through primary, secondary or tertiary, etc., channels. Each specific situation is unique unto itself, except that the passage of the information is sequential in nature, and tends to be of lateral movement. Rogers and Shoemaker (1971) labelled this as 'homophily' which refers to the similarity of individuals in an interacting pair regarding their beliefs, values, education and social status. These authors stated that communication is usually better between people of like attributes, so once a new idea has entered a social system it tends to remain within the social level of introduction. As well, they contended that innovations usually enter through higher status levels, and that this acts as a restraint on the complete assimilation of the idea by the remaining status levels. Therefore the efficiency of an innovation's diffusion relies upon the attempt by the change agency to address respective status level opinion leaders (Rogers and Shoemaker 1971).

Heterophily, on the other hand, is where communications occur between followers on one level and opinion leaders who usually occupy the next higher level (Rogers and Shoemaker

1971). The authors reported that the competency level of the diad is greater, but not significantly so, since the follower must feel comfortable in this exchange of information. Higher education and social status are two measurable variables that may aid in assessing an opinion leader's potential, other aspects of this position's profile follow. It is this communication process which must be encouraged through greater agency contact with opinion leaders; however, care must be taken to avoid the alienation of an opinion leader from his usual followers, for then the relationship will be more heterophilous than homophilous and communications will fail.

The Role and Characteristics of Opinion Leaders

There are four major identifying traits associated with opinion leaders as presented by Rogers and Shoemaker (1971). First with 'external communication' opinion leaders have more interaction with mass media, a greater degree of cosmopolitan behaviour and increased association with change agents than their followers. Second, accessibility to their followers is direct, and they also are more socially active than their followers. Third, opinion leaders have a higher social status than their followers. Fourth, while opinion leaders are not usually the initiators of an innovation, their receptivity to innovative change is greater than that of their followers, therefore their acceptance and adoption of new ideas is relatively earlier than other social system members.

The effect of strong interpersonal communications between an opinion leader and his followers may be seen in a statement made by Arndt (1968g) and referenced by Rogers and Shoemaker (1971:219): "Those receiving favorable word-of-mouth communications were three times as likely to buy the new product as were those receiving unfavorable word-of-mouth.".

It seems readily apparent that those individuals within the social system of Alberta trout anglers who are, or could be, operating as opinion leaders have an important role in the diffusion of the catch-and-release program. It must be proven to such individuals that there

is a relative advantage to the concept before the adoption-diffusion process is endorsed in earnest by opinion leaders. Such an effort should not concentrate too heavily on such potential opinion leaders, but instead on all members of the social system to avoid reducing the effectiveness and acceptance of the chosen opinion leaders among their followers.

C. The Diffusion of Innovations

Progression of the Individual's Developmental Process

Muth and Hendee (1980) pointed out that when the decision to adopt an innovation is made on an individual basis, the overall process may take a long time; however, the catch-and-release program does not have to be supported by every angler in order for it to succeed. When enough individuals become aware and continue to express an interest in this management strategy, the remaining people should accept it as a viable alternative.

An individual may progress from learning about an innovation, such as catch-and-release, to adoption and continued use by a sequential process. There are five steps in the individual's decision-making process as defined by Rogers and Shoemaker (1971): awareness, interest, evaluation, trial and adoption or rejection.

1. The awareness stage is when exposure of the individual to the innovation occurs. Mason (1964) found that mass media are used most at this stage.
2. The interest stage occurs when those individuals desiring more information about the innovation actively seek out more data to increase their understanding, enabling them to make a judgement. Greater detail of knowledge is needed for such a situation and mass media channels still provide much of the interest needs (Mason 1964).
3. Third is the evaluation stage when those individuals undertake a theoretical simulation of applying the innovation, balancing the advantages and disadvantages of the innovation's characteristics and its use. At this stage, personal contacts are far more effective than mass media (Mason 1964).
4. Some people go on to the trial stage when they try out the innovation in a low-risk

environment to test and assess the functionality of the innovation. Interpersonal communication within the social system is essential at this stage. "Friends, neighbors, peers, and government agents are consulted most often, because detailed technical information is needed as well as reassurance that the new technology has indeed worked for someone else." (Muth and Hendee 1980:143). The individual will seek out those people with like-interests within their own interpersonal network. Anglers would similarly seek informed sources and could use many varying communication channels to gather data about both general interest topics as well as regulatory measures such as catch-and-release.

5. If, in his testing of the innovation, the individual experiences satisfaction from its use, then the final stage of adoption or rejection will probably result in adoption by the individual.

Mason (1964) asserted that intelligent decision-making is based upon the individual's accumulation of relevant interest data prior to selection whereas innovation acceptance and adoption is evaluated through maintaining sources of knowledge about its successful applicability within the concerned social system. Information seeking can be done by individuals before and after adopting an innovation (Mason 1964). Thus if an angler practices catch-and-release ethics on an occasional basis, he would still seek information to reconfirm his original adoption of the idea and to decrease any encountered dissonance. Finally, "more information may be used to gain support for a new practice that has been adopted than is used to acquire knowledge prior to adoption."(Mason 1964:52). Change agencies promoting a new practice must provide individuals with a constant information flow, regardless of their stage achieved in the adoption process. Fish and wildlife agencies should ensure that they have a balanced information dissemination program while maintaining a diversity of communication channels and resource contacts within the social subgroups of these wildlife recreational users.

Progression of the User Group Developmental Process

Rogers and Shoemaker (1971) compared adopter distributions to the normal learning curve and concluded that adopter distributions were expected to be normal in form, such that exposure and interaction with the new idea was accumulated as each additional individual became an adopter. Based upon the distribution of a sample under the standard bell curve, it has been proposed that for the five literature-defined adopter categories there is a cumulative tendency toward adoption of a new practice from the innovators and early adopters through the early and late majorities to the least innovative individuals of the population. The larger proportions of the sample's distribution are approximately equal (@ 34% each), falling within one standard deviation of the sample's mean relative speed of adoption. The adopter categories flanking this major part of the sample compose the balance of the sample (32%), all categories falling within three standard deviations of sample mean. The last category likely to adopt an innovation are those individuals who trail the sample's mean rate of adoption. Termed as laggards in the literature, this proportion of the sample is approximately 16% and their position is between two and three standard deviations away from the sample mean. Those categories who are likely to adopt the innovation before the majority of the sample also compose approximately 16% of the sample and fall between two and three standard deviations in advance of the sample mean. Early adopters are defined as those individuals who adopt an innovation in advance of the majority of the sample and compose 13.5% of the sample, whereas innovators lead all adopter categories in that they are the individuals who introduce the innovation to the balance of the sample and are the smallest sized category at 2.5%.

Some of the properties attributed to these adopter categories, which are ideal types or conceptualizations based on observations of reality include exhaustivity (excluding non-adopters), mutual exclusitivity and derivation from one classification principle (Rogers and Shoemaker 1971). These properties allow for the segmentation of the social system into relatively distinct units of progression; therefore, specific characteristics and subcultural values of the adopter categories mentioned above have been delineated (see Table 4).

Table 4. Adopter category characteristics and values.

ADOPTER CATEGORY	CHARACTERISTICS AND VALUES
Innovators	- venturesome - eager to try new ideas - become involved in more cosmopolitan social relationships - communication patterns and friendships among a clique of innovators are common
Early Adopters	- respectable - localites (versus cosmopolite) - have the greatest degree of opinion leadership - 'the man to check with before using a new idea' - serve as role models for others
Early Majority	- deliberate - rarely hold (opinion) leadership positions - follow, do not lead
Late Majority	- skeptical - adoption may be both an economic necessity and the answer to increasing social pressure - do not adopt until most others in their social system have done so - system norms must favor the innovation before adoption occurs - pressure of peers must occur to motivate adoption
Laggards	- traditional - last to adopt - most localized in their outlook of all adopter categories, many are near isolates - point of reference is the past - suspicious of innovation, innovators and change agents

(Rogers and Shoemaker 1971)

While these characteristics define a conceptualized spectrum of adopter categories, in reality there are difficulties in establishing the exact stage of progression into which an individual might be placed since individuals change over time and more rapidly in some ways over others. As with all theoretical classificatory systems, flexibility in the assignment of an individual to a conceptual category is inherent and cannot be avoided.

D. The Role of the Agency and Associated Individuals in the Process of Change

Several conceptions of 'change agents' exist in innovation adoption-diffusion research. Strictly defined, a change agent would be understood by many to mean the person or group who is attempting to effect change. However, Rogers and Shoemaker (1971) contended that a change agent is a professional who influences innovation-decisions in a direction deemed desirable by a change agency. So, while there are discrepancies, there is an overall consistency.

The term 'agent of change' has been coined by this researcher to convey the total aspect of intervening influences between the subject population and the change agency itself. In addition to full-time-professional change agents there are individuals who may be following the same mandate of their own free will in related services. One example might be an owner or employee of a fishing tackle product/service outlet who is knowledgeable about new equipment, techniques and environmental ethics and tries to keep his customers well-informed. While this person may also be an angler, his position in his work would lend credibility to the change agency even though he is not related with the change agency. An individual of this nature would also be an opinion leader within his own social fishing group but would in effect be an agent of change through his work.

Seven roles have been identified in the process by which a professional change agent (e.g. a communications officer) introduces an innovation to his clients (Rogers and Shoemaker 1971:229-230). These should be taught to all professional representatives and employees who interact with the public.

1. "Develops need for change -- helps his clients become aware of the need to alter their

behavior."

2. "Establishes a change relationship -- develops client rapport -- tries to first gain personal acceptance, followed by the clients' acceptance of the innovation."
3. "Diagnoses the problem -- looks at the clients' situation in order to identify their underlying motives and thus needs."
4. "Creates intent to change in the client -- motivating the change around the client."
5. "Translates intent into action -- works to promote compliance."
6. "Stabilizes change and prevents discontinuances -- reinforcement of adoption through follow-ups."
7. "Achieves a terminal relationship -- encourages client self-sufficiency."

Research has revealed several applicable generalizations regarding the role a change agent has, and the characteristics associated with an effective change agent (Rogers and Shoemaker 1971:233-241). The application of these guidelines should be encouraged within the change agency.

1. "Change agent success is positively related to the extent of effort he expends."
2. "Change agent success is positively related to his client orientation, rather than to change agency orientation."
3. "Change agent success is positively related to the degree to which his program is compatible with clients' needs."
4. "Change agent success is positively related to his empathy with clients."
5. "Change agent contact is positively related to higher social status among clients."
6. "Change agent contact is positively related to greater social participation among clients."
7. "Change agent contact is positively related to higher education and literacy among clients."
8. "Change agent contact is positively related to cosmopolitaness among clients."

Thus change agents must establish their credibility within the client system in order to ensure their effectiveness; credibility being "the degree to which a communication source or

channel is perceived as trustworthy and competent by the receiver." (Rogers and Shoemaker 1971:244). The professional change agent's success relies upon how credible he/she is in the eyes of the clients and whether efforts to increase the clients' ability to evaluate innovations have succeeded. To sum up, the goal of such planned change programs is client independence of the change agent.

From this perspective, the change agency's role through the professional change agent is to establish the relevancy of the introduced innovation to the entire client system. The catch-and-release no kill program will probably not be unilaterally accepted by all segments of the trout angling social system. However, the premise is not to have all anglers actively practicing only catch-and-release to the exclusion of the more traditional behaviours, but rather to instill within the individual and the system, an ethical consideration of the values of our sport fisheries in hope of developing an awareness and appreciation of natural resource conservation. As to why catch-and-release programs are being considered in the first place, there is an urgent need to start educating anglers today in order to maintain quality fishing experiences.

Other agents of change exist as well, but they are less overt in that they are societal trends and norms, rather than individuals from within/without the trout fishermen social system. Such agents are much less directed, do not specifically address the particular innovation of concern and are of a broader societal nature and impact. Some of these social perspectives have surfaced in more recent times, whereas others have been present much longer and can be traced to cultural and ethnological origins.

Relevance to the Problem

Rogers and Shoemaker (1971:158) identified the five major variables that determine an innovation's rate of adoption. In their paradigm they include:

1. Perceived attributes of the innovation ... (including): ... relative advantage, compatability (with previous behavior), complexity, ... (trial potential) ... and observability.

2. Type of innovation-decision ... (either) ...optional, collective or authority.
3. Communication channels ... (including): mass media and interpersonal.
4. Nature of the social system ... (either) ...traditional or modern norms and the degree of communication integration.
5. Extent of promotion efforts by change agents.

These five variables need to be analysed in context with the catch-and-release program in Alberta in order to ascertain its rate of adoption. While this study does not claim to fully assess the current status of the catch-and-release program, an attempt will be made to at least address the perceived attributes of this initiative (four of the five characteristics are applicable). Additionally, some inferences can be made about the remaining four variables that should aid in determining the rate of adoption of the catch-and-release program in Alberta.

The manner in which this trout management program was initiated seems to indicate that the type of innovation-decision made was definitely not a collective one, but that it probably combined aspects of both an optional and an authority decision. Anglers must release all cutthroat trout caught on the North Ram River (a site-specific authority decision), however all anglers have available an optional decision to release fish on any fishery should they so desire.

The nature of the Alberta trout fishermen social system is much more difficult to infer. However the recent advocacy of anglers for policies such as catch-and-release would seem to indicate that perhaps there is a shift of norms from the traditional to the modern. As far as the degree of communication integration among the management agency and its client publics, this is most likely improving somewhat but has as yet to achieve its fullest potential. This stage of development is very likely also reflected in the extent of promotion that is currently in place, in other words, relatively minimal in comparison with other promotional campaigns.

Regarding the last variable of impact upon the rate of adopting the catch-and-release program, resource planners and managers have a responsibility to establish creative communication links with and amongst the trout fishermen client system typologies in order

to make the most of all channels of communication available. Active and participatory measures need to be employed to properly reach each of these subgroups with the appropriate directed messages, relaying the crucial information in a way which will be acceptable and non-threatening and allows the individual to make his/her own choice. One study in particular concerning the redistribution of users in the backcountry by Krumpe and Brown (1982) suggests that relating the information to the recreation experience will achieve results. They designed a trail selector outlining the full spectrum of backcountry routes, which, when distributed with a map of the area persuaded up to 23 per cent more users to take one of the lesser used trails. This has implications for how management can influence the decision-making process of resource users. If appropriate information describing the attributes of different regional sport fisheries is made available and designed as a decision matrix, then anglers will be able to select the optimal setting for satisfying their expectations of a quality sport fishing experience.

Results from Lucas (1981) regarding the effect of information on the redistribution of wilderness users in the backcountry, found that the usefulness of an information dispersal program varied greatly. Lucas (1981) implied that it was how the information was used which dictated the success of management initiatives. His recommendations are summarized here.

1. Management objectives should be the bases for information campaignss (e.g. redistribution in general or specific to a site or a better fit of experiential opportunities and visitor expectations.
2. A major proportion of the visitors must receive the information.
3. The visitors must receive the information early in their recreation location choice process.
4. Various attributes need to be covered in the information including the environmental, social and managerial setting.
5. To increase credibility the information must be very rich in detail.
6. A variety of message delivery modes are essential in an information campaign.
7. Encorage exploration and/or discovery instead of over informing.

In addition, by corresponding effectively with the opinion leaders of all segments of the client system, placing informed and perceptive individuals in public interaction positions as change agents, continually monitoring changing societal perspectives and undertaking the education of all licenced anglers on an independent basis (e.g. bulletins, brochures, etc.), the rate of acceptance by the trout fishermen social system of both the sportsmen's conservation ethic and the trout management catch-and-release program will be faster and much more effective. Continual educational efforts are mandatory and essential across the entire client system so that potential benefits accrue for all anglers while maintaining the integrity of our environment and its wildlife.

Finally, care must be taken to fully understand the client system. Once established, all communication flows and links need to be strengthened to ensure their future viability and usefulness. Information dissemination will assume an even greater role within the trout fishermen social system after the adoption of the catch-and-release trout management program in order to stress the continued importance of ethical behaviour in the use of our trout fisheries as well as ensuring that all anglers seeking quality fishing experiences know the range and the various alternatives available within Alberta's spectrum of trout fisheries.

The introduction of the catch-and-release trout management program in Alberta is a process of planned change by the Alberta Fish and Wildlife Division. While initial persuasion may have been due to an effective lobby of organizations centered mainly around fly fishing, the direct and indirect benefits for both anglers and sport fisheries through such a program constitute the primary rationale, in that a segment of the angling social system may derive quality angling experiences from this opportunity. This innovative management strategy, while directly appearing to benefit fly fishermen only, indirectly allows for a better allocation of all trout fisheries among trout anglers so that there is an even distribution of this public resource among all users. As well it may reduce conflict among users having different perceptions and behaviours toward angling by segregating use based upon a voluntary choice to optimize their quality fishing experience by selecting a particular combination of trout fishery characteristics

(i.e. quantitative and/or qualitative creel aspects as well as environmental and/or social setting attributes).

VI. METHODOLOGY

A. Survey Population

The scope of this research is intended to make broad inferences about trout fishermen in the province of Alberta with special reference to their views concerning catch-and-release trout regulations. While not all anglers fish for trout, those who do are fairly consistent as to the degree of effort expended and have formed definite opinions and attitudes toward trout fishing and its management.

In order to achieve a sufficient sample size to ensure the validity and reliability of research results, it was necessary to select a highly accessible trout stream as well as one which might attract a wide cross-section of trout fishermen.

Shunda Creek is easily reached from all three major Alberta cities, being almost equidistant between Edmonton and Calgary and closer to Red Deer than either of the larger population centers. It is an attractive foothill stream which provides brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*) fishing. It is close to the service community of Nordegg and only minutes drive away from the intersection of the David Thompson Highway and the Forestry Trunk Road - which itself attracts vacationers, many of whom are anglers.

B. The Survey Instrument

The personal interview with predominantly open-ended questions was the chosen survey instrument, as the scope of conceivable responses was deemed to be most worthwhile for the purpose of this exploratory research study. Face-to-face dialogue with the interview subject also enabled clarification of statements.

The process of developing the survey instrument was approached in the following manner. Initially, several research papers related to the social-psychology of sport fishermen were reviewed: Warner 1979; Bjornn 1978; Bryan 1979; Hendee et al. 1977; Hoaglund 1973; Potter et al. 1973; Knopf et al. 1973; Moeller and Engelken 1972; Field 1974; Gordon et al.

1969. Following this review, a preliminary interview was designed utilizing various lines of questioning found in the literature. The instrument was then pretested in the summer of 1982 in the general Nordegg area. Revision of the interview questions was done prior to the main fieldwork of the summer of 1983, both through informal pretesting and a further examination of related research previously uncovered. Suggestions and advice received from several Department of Forest Science faculty members and from Alberta Fish and Wildlife Division personnel were incorporated.

C. Data Collection Procedures

The investigation was based out of the Nordegg Ranger Station, approximately 3 km east of Nordegg on the David Thompson Highway. The study area, as previously mentioned, had three major campgrounds and several pull-off spots along the highway itself. For ease of contact, it was decided to designate each campground as a specific interview location, and a fourth interview location was defined as any pull-off spot along the highway where anglers or evidence of anglers (e.g. parked car) were observed between Harlech Recreation Area and the Upper Shunda Recreation Area. This allowed for contacting the maximum number of anglers possible in various environmental and social settings. Interviews were conducted on an informal basis and were done only at the discretion of the individual(s) approached, either in the field or at camp. Members of the investigative team wore name tags which allowed easy identification by all parties contacted.

An interviews was initiated with every randomly selected individual approached, but not every person had been sport fishing. So even though the final sample size for completed interviews was 266, the overall number of contacts was greater.

The data collection period extended from the 26th of June through to the 5th of September 1983, for a total of 72 field days. Thus, the daily average number of interviews was 3.69. Each period of contact time varied according to the subject's degree of interaction; however, the first 10 minutes, at a minimum, were spent administering the specific interview

questions. All questions except one were presented in verbal form, the exception being a series of 10 illustrations, consisting of five Alberta fish and five natural trout food sources, which the subject was asked to identify by common name. As well, the last item in the interview was to enquire as to whether the subject had questions regarding the survey or the catch-and-release trout management program. During the entire field season, every angler randomly contacted through the sampling procedure agreed to be interviewed. Only one subject did not complete the entire interview once started, citing a lack of available time for completing the interview. Participants seemed to enjoy responding to the questions and having their opinions recorded. Finally terminating an interview was far more difficult than completing an interview.

D. Survey Sampling Procedures

For the four interview sites defined for sampling purposes, random selection procedures were administered in the following manner. Two different sets of cards were designed, one set having four cards with one interview site on each card, the other set being numbered from one (1) through six (6), signifying six (6) one hour time slots (used twice daily over the full 12 daily interview hours). At the start of each interview day, three morning interview times (8 a.m. to 2 p.m.) were randomly selected for that half-day and then each one was matched with a corresponding interview site card which was also randomly selected utilizing the replacement process. The same process was repeated when afternoon/evening interview times (2 p.m to 8 p.m.) were selected. Once the morning or afternoon agenda was finalized, the interviewer would present himself at the appropriate location and would contact the first person encountered. Not every person so contacted was an angler, so the interviewer would actually interview the first angler found. This was not always as straight forward as described since often vehicles would be present, but due to the nature of fishing, the individual would either be up or down stream. If the interviewer could not locate the angler after a short search, then he would return to the vehicle and wait a maximum of 10 minutes

in hopes of intercepting the returning angler. With this system it was not possible to predict when the interview would be held, even if it was scheduled on the hour. Only those anglers who were at least 16 years old were interviewed. On occasions, the angler contacted asked that the interview be rescheduled for a time later in the day, and the interviewer did so when feasible.

All interview forms were pre-numbered for ease of sorting and once completed, were reviewed by the interviewer to ensure accuracy.

E. Treatment of the Data

Processing

The survey questionnaire was purposefully designed using open-ended questions, so upon completion of the field work, the first step was to design a codebook which defined categories of response to each question and also assigned a numeric value to each category for all questions. Utilizing the code book, all interview forms were then coded appropriately onto Optical Multiple Response (O-M-R) computer data sheets for entry into the computer. A random check on all completed computer code sheets was done to ensure an accurate transferral of data. As well, once the data were entered into the computer, a computer-assisted scan of valid numeric fields for each question's response was the final check for data transferral accuracy.

The next procedure involved the running of frequency tabulations for all responses. This enabled the collapsing of some categories into others when it was deemed that there would be little loss in detail and meaning. Eventually, all response categories were organized into the final format utilized for data analysis.

Analysis

The analytical software package called the Statistical Package for the Social Sciences (SPSS-X), available through the University of Alberta's Computing Services Department was

used by the researcher.

The non-parametric statistic used was a chi square analysis of the data. When sample size dictated a verification of accuracy because of the number of expected frequencies in a particular cell being under ten, the statistical procedure for the correction for continuity was applied (Blalock 1979). Variables of interest, as defined in the theory being examined, were tested separately as the independent variables across specific identified descriptive variables and other possible intervening, dependent variables. The chi square test of independence of categorical variables was used because the size of the sample exceeded 30 and because the data were predominantly nominal.

While the chi square test of independence indicates little about the strength of a relationship, it did determine when an association existed between two sets of attributes in the population. The second stage of data analysis involved the running of several simple one-way analyses of variance (ANOVA) statistics at the 0.05 confidence level of significance. The predominant dependent scalar variable of angler acceptance of the catch-and-release innovation was examined with this parametric technique.

Each angler's acceptance of catch-and-release was measured by asking a series of questions dealing with their perception of both the North Ram River experimental program and the general concept of the catch-and-release innovation. A total of ten questions were administered which enabled the researcher to compile separate scores for each of the four applicable characteristics of the catch-and-release program. Thus a measure of how an angler perceived the relative advantage of this program was determined by summing the responses to three specific questions dealing with: the worthiness of the concept, the attraction of such a fishery to the angler and the relevance of program expansion toward the provision of future satisfactions and benefits. The compatability of the catch-and-release innovation to each individual angler's existing values, past experiences and needs was determined by summing the responses to three other questions encompassing: whether the angler was already in the habit of releasing fish, the previous experience fishing on a catch-and-release fishery outside of

Alberta and the angler's need for a permanent catch-and-release fishery. The angler must be able to understand how the innovation works in order to assess whether it is of value, therefore the complexity of the catch-and-release program will also affect acceptance. The complexity of the program to each angler was determined by summing the responses to two questions including: the degree of understanding about the catch-and-release innovation and the knowledge of differing mortality rates induced by the technique used and the manner of releasing the fish. The fourth characteristic that was measured for each angler was the opportunity to try releasing a fish. Experimentation with the innovation on a limited basis is an important factor. Since catching and releasing a fish is not limited to a mandatory catch-and-release fishery, anglers have always had this opportunity present, although they may not have been aware of it. Two questions were administered dealing with the trial potential of releasing a fish: the anglers' willingness to comply on a mandatory catch-and-release fishery and specific opinions about the presence and provision of an experimental fishery where the innovation can be tried.

All of these ten questions were administered to each angler who was asked to respond either in the affirmative or negative if applicable, or as in the case of angler understanding of the catch-and-release program, the degree of knowledge was evaluated as either totally knowledgeable or not sufficiently knowledgeable. Thus for those characteristics comprised of three questions (relative advantage and compatability), a score of either zero, one, two or three could be achieved where answers in the affirmative would each receive one point (a negative response or no response would tally a score of zero) and the sum of these scores within each characteristic would yield each angler's measure for that characteristic. For those characteristics comprised of two questions (complexity and trial potential), a score of either zero, one or two could be achieved based on the same rating system. Then, to derive a total angler acceptance score for the catch-and-release program the subtotals of each of the four characteristics were summed cumulatively to yield a range of potential angler acceptance from zero through ten inclusive. For analysis purposes this total cumulative score is used, as well as

a breakdown of low (0-3), medium (4-6) and high (7-10) angler acceptance categories. The following formula describes this cumulative scalar variable.

Angler Catch-and-Release Acceptance = Relative Advantage (0-3) + Compatability(0-3) + Complexity (0-2) + Trial Potential(0-2)

VII. RESULTS

A. Preamble

The developed angler terminal tackle profiles following include those characteristics and participatory behaviours which should give the management agency a direct applicability of information toward developing a range of experiential quality angling opportunities throughout the province. Therefore the variables chosen to compose these profiles of terminal tackle angler typologies are relevant to both the need to understand trout angler acceptance of the catch-and-release program and the need to begin compiling data on anglers toward the comprehension of the experiential components of the quality angling spectrum in Alberta.

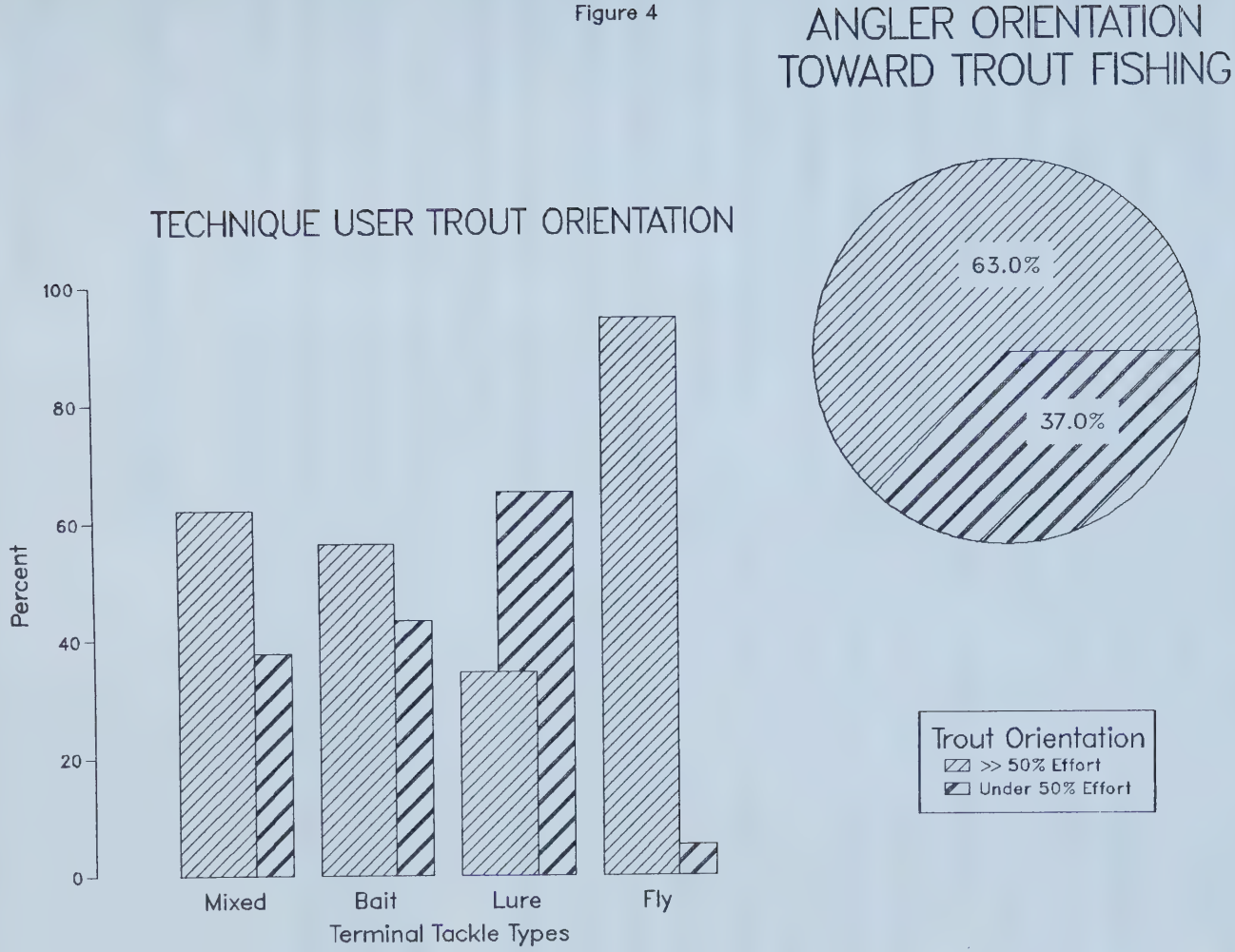
B. Clarification of Angler Terminal Tackle Typologies

The primary intent of this chapter is to identify and define the subsamples of anglers who fish the Nordegg area, and to then determine their receptivity toward the catch-and-release trout management program in Alberta and on the North Ram River.

In order to define profiles for the subsamples, angler trout orientation and technique use were selected as the major definitive variables. After describing how anglers are oriented toward trout and their terminal tackle preference, the sections following will initially describe the total sample response to all questions. Then responses by trout-oriented anglers will be examined by a categorization of their technique use (i.e. bait, lure, fly anglers or non-specialists). Therefore trout-oriented specialists are those anglers who fished more than 50% of their time for trout species with one predominant terminal tackle (more than 50% use of bait, lures or flies). Trout-oriented non-specialists are those anglers who fished more than 50% of their time for trout species but less than 51% of their time with at least two different angling techniques.

Approximately 63% of anglers interviewed indicated that they preferred to fish for trout more than half of their angling time (see Figure 4). Among the three technique

Figure 4


ANGLER ORIENTATION
TOWARD TROUT FISHING
63.0%
37.0%
Trout Orientation
>> 50% Effort
Under 50% Effort
TECHNIQUE USER TROUT ORIENTATION
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types

specialist categories, anglers using flies were definitely trout oriented (95%). Those anglers who used bait had a slim majority who were trout oriented (56%) whereas only 35% of lure anglers were trout oriented. Non-specialists had almost two-thirds indicate that they were trout oriented (62%), (Chi-square = 43.2; d.f. = 3; $p < 0.0001$).

One other association of importance was that when trout-oriented anglers were compared to anglers who did not predominantly fish for trout, their preference was more favourable towards limits and much more favourable toward stocking. Angler preferences for catch-and-release management differed very little among the subsamples (see Table 5).

Over one-third of all anglers interviewed did not use a specific type of tackle or technique more than half of their time; rather they used a combination of all techniques and equipment. Specifically, 26% used bait more than half of their angling time while 18% used lures more than half of their angling time, and 22% used flies more than half of their time. Those anglers who used their preferred technique predominantly are often referred to as technique specialists (i.e. fly anglers) throughout the context of this thesis and sometimes in conjunction with their orientation toward trout species. The mean use by anglers of the three techniques were: natural bait - 37%, artificial lures - 31% and flies - 32%. Table 6 summarizes the technique use of all anglers interviewed.

Now that an initial description of the trout orientation of anglers has been addressed and that their use of terminal tackles has also been clarified, the sample will be analysed with respect to the completion of angler profiles which will assist in determining who are the most accepting of, and supportive toward the catch-and-release program in Alberta.

C. Profile Development: Terminal Tackle Typologies

Socio-demographics of Anglers

The youngest angler interviewed was sixteen years old while the oldest angler was 81 years old; the mean age of anglers was 35 (see Figure 5). As can be seen in the accompanying

Table 5. Fishery Management Preference by Angler Trout Orientation

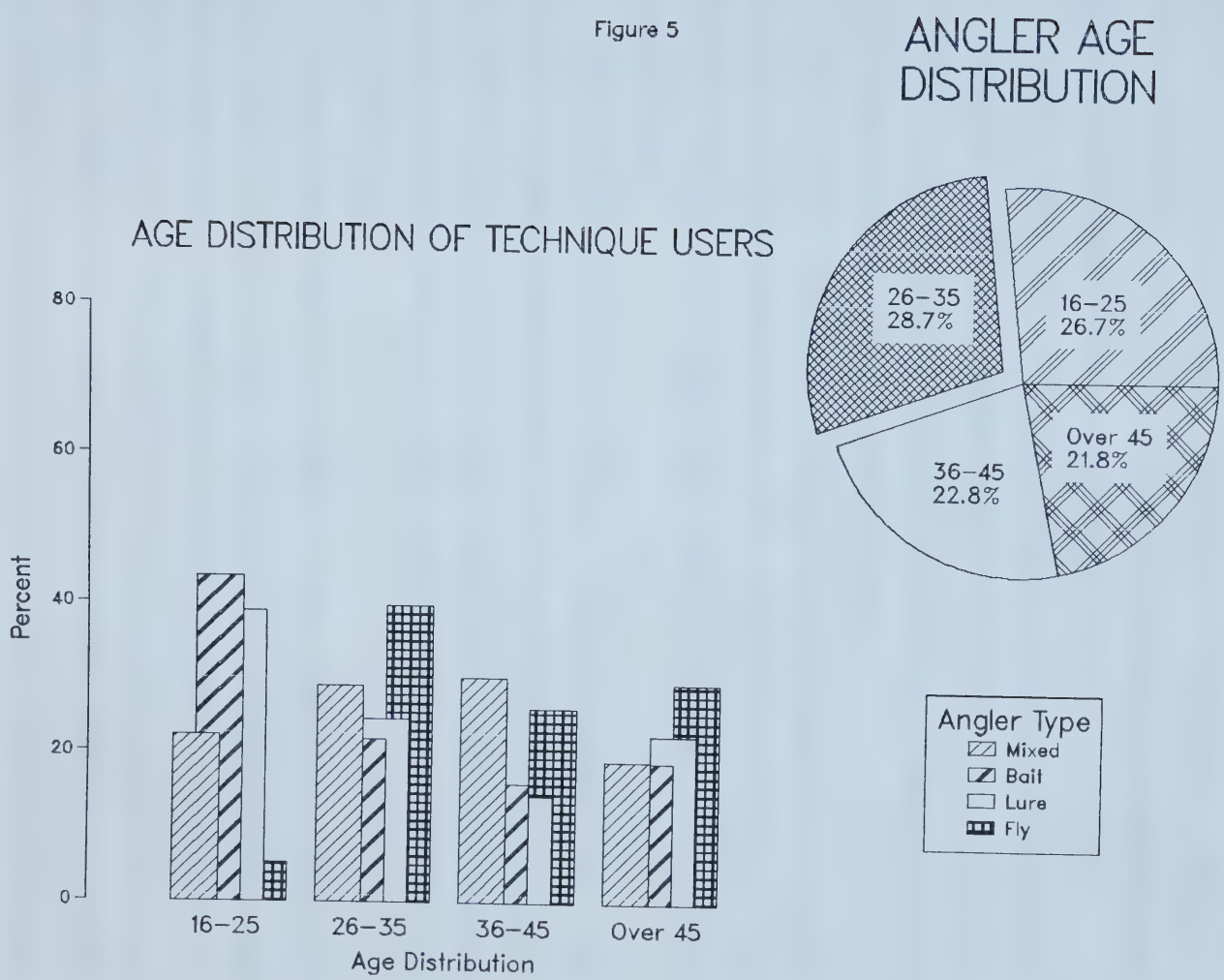
Management Preference		Management Preference	
Trout-Oriented		Non-Trout-Oriented	
Limits:	45%	Limits:	40%
Stocking:	32%	Stocking:	21%
Catch-and-Release:	17%	Catch-and-Release:	16%
Closures:	6%	Closures:	23%
Total: (n)	147	Total: (n)	86

(Chi-square = 11.7; d.f. = 3; $p < 0.01$)

Table 6. Percentage of Time Fishing by Distribution of Tackle Types

Fishing Time	Distribution of Tackle Types (%)		
Percentage	Bait	Lure	Fly
100%	7	5	8
50%	18	14	13
1% to 50% (incl.)	74	82	78
0%	25	30	37

Figure 5


ANGLER AGE DISTRIBUTION
26–35 28.7%
16–25 26.7%
Over 45 21.8%
36–45 22.8%
Angler Type
Mixed
Bait
Lure
Fly
AGE DISTRIBUTION OF TECHNIQUE USERS
Percent
80
60
40
20
0
16–25
26–35
36–45
Over 45
Age Distribution

table, anglers in the youngest age category used bait tackle the most (42%) and flies the least while those in the next oldest category (26-35) were relatively evenly divided between using a mixture of tackles or predominantly flies at approximately 30% each. Forty-five per cent of anglers in the 36-45 age range used a combination of techniques (38%) although this percentage dropped back down to 29% in the oldest angler category which was also the same percentage of these same aged anglers using flies. Refer to Table 7.

Younger anglers were more likely to primarily rely on word of mouth sources for general fishing information followed by government sources; whereas the oldest anglers relied almost equally upon discovering such information on their own and through their own word of mouth sources (Chi-square = 43.4; d.f. = 9; $p < 0.0001$).

The data analysis revealed that while the youngest anglers tended to prefer catching many small fish, older anglers still preferred to catch a couple of large fish; however it also appeared that the popularity of catching several medium fish remained relatively constant with age. See Table 8.

While the mean education held by anglers was slightly more than a grade twelve education, 29% of anglers interviewed reported that they had not yet attained a high school diploma, 56% of the interviewees said that they had attained such a diploma as well as some post-secondary education. Fifteen per cent of the anglers indicated that they had received at least one university degree.

In Figure 6 and in Table 9, it may be seen that anglers having less than a high school education primarily used bait tackle (45%), followed by the use of a mixture of tackles (32%). For those anglers with the next highest level of education, the predominant use was a mixture of tackles (35%) followed by fly anglers (26%). For those anglers with at least one university degree, using either a mixture of tackles or flies was sufficient, while lure use remained relatively constant at an approximate average of 20%. Bait was less important to these anglers as only eight per cent used bait. It may be that with increasing educational attainment that anglers' technique use tends to evolve away from bait tackle.

Table 7. Terminal Tackle Use by Trout Angler Age.

Technique Use	Trout Angler Age (Years)				
	16 to 25	26 to 35	36 to 45	Over 45	Total (%)
Non-specialists	28	34	45	30	34
Bait Specialists	42	20	18	22	26
Lure Specialists	26	16	12	19	18
Fly Specialists	4	30	25	29	22
Total (n)	72	76	60	58	266

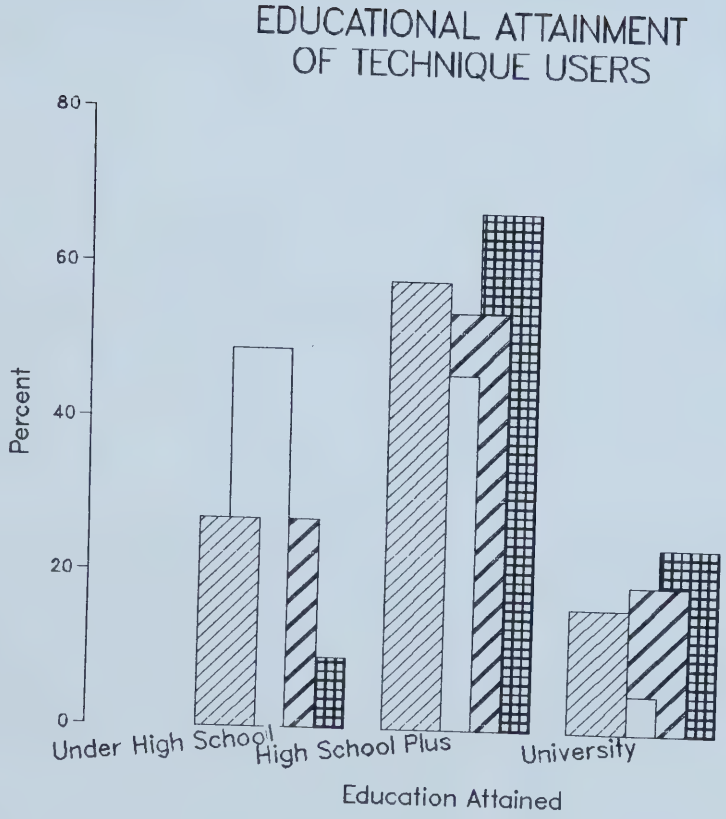
Chi-square = 31.8; d.f. = 9; $p < 0.01$.

Table 8. Catch Preference by Angler Age

	Angler Age				
Preferred Catch	16-25	26-35	36-45	Over 45	Total (%)
Many small	19	7	2	5	9
Several medium	57	72	68	67	66
Couple of large	24	21	30	28	25
Totals (n)	72	75	60	57	264

(Chi-square = 16.7; d.f. = 6; $p < 0.05$)

Figure 6


EDUCATIONAL ATTAINMENT
OF TECHNIQUE USERS
80
60
40
20
0
Percent
Under High School
High School Plus
University
Education Attained

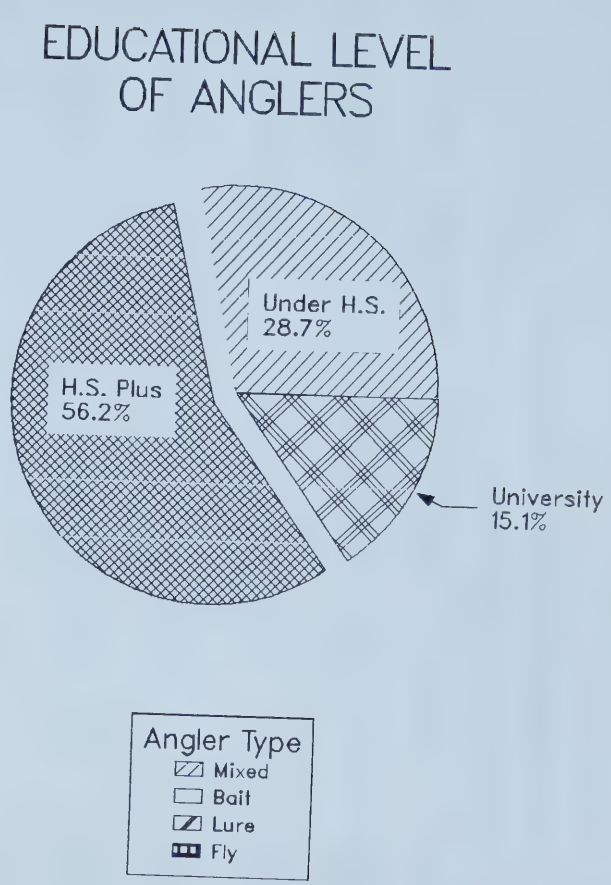

EDUCATIONAL LEVEL
OF ANGLERS
Under H.S.
28.7%
H.S. Plus
56.2%
University
15.1%
Angler Type
Mixed
Bait
Lure
Fly

Table 9. Terminal Tackle Use by Trout Angler Education.

Technique Use	Trout Angler Education			
	Under High School	High School Plus	University	Total (%)
Non-specialists	32	35	35	34
Bait Specialists	44	22	8	26
Lure Specialists	17	17	22	18
Fly Specialists	7	26	35	22
Total (n)	76	149	40	265

Chi-square = 29.9; d.f. = 6; $p < 0.0001$

It was also found that an angler's degree of resource knowledge was positively related to his educational attainment. There is a logical linkage between two similar variables, so this finding was to be expected, although verification of its existence was important as a descriptive measure of angler profiles. Refer to Table 10.

Every angler interviewed was asked to describe their occupation type. Using a formula devised for Statistics Canada data, each angler was given a socio-economic status according to a prestige ranking from 1 to 600. Then these rankings were subdivided into three equal-sized socio-economic status levels from low (1-200), through intermediate (201-400), to high (401-600). It was determined that 23% of the anglers were of the highest socio-economic status level, 25% of the anglers were of the intermediate status level and 52% of the anglers were of the lowest status level (refer to Figure 7).

In Table 11 it may be seen that the greatest proportion of low status anglers used bait tackle (34%) and that a similar percentage of anglers used a mixture of all tackles (32%). For anglers of an intermediate status level, almost two-fifths of the subsample used a mixture of tackles (37%), lure usage dropped along with bait usage while flies were used by a greater number of anglers. High status level anglers used almost every type of tackle equally (approximately 30% each) except for bait tackle (used by only 8% of this subsample).

The predominant majority of low status anglers tended to have less than 20 years of experience (66%). Surprisingly there was a higher representation of these least experienced anglers found in both the high and low status levels (approximately 32% each) than in the intermediate status level (15%). In addition, the data analysis revealed that anglers belonging to a fish and/or wildlife organization were more likely to be of an intermediate socio-economic status (Chi-square = 9.2; d.f. = 2; $p < 0.01$). Anglers of a high socio-economic status also preferred to catch a couple of large fish (Chi-square = 10.1; d.f. = 4; $p < 0.05$). A relationship which will be discussed in full later shows that anglers of a high status level also have more catch-and-release experience than do anglers of other status levels (Chi-square = 6.3; d.f. = 2; $p < 0.05$).

Table 10. Resource Knowledge by Angler Educational Attainment

Resource Knowledge	Educational Attainment			
	Under High School	High School Plus	Universty	Total (%)
Low (0 to 3)	80	48	45	56
Medium (4 to 6)	16	35	30	29
High (7 to 10)	4	17	25	15
Totals (n)	76	149	40	265

Chi-square = 26.6; d.f. = 4; $p < 0.0001$.

Figure 7

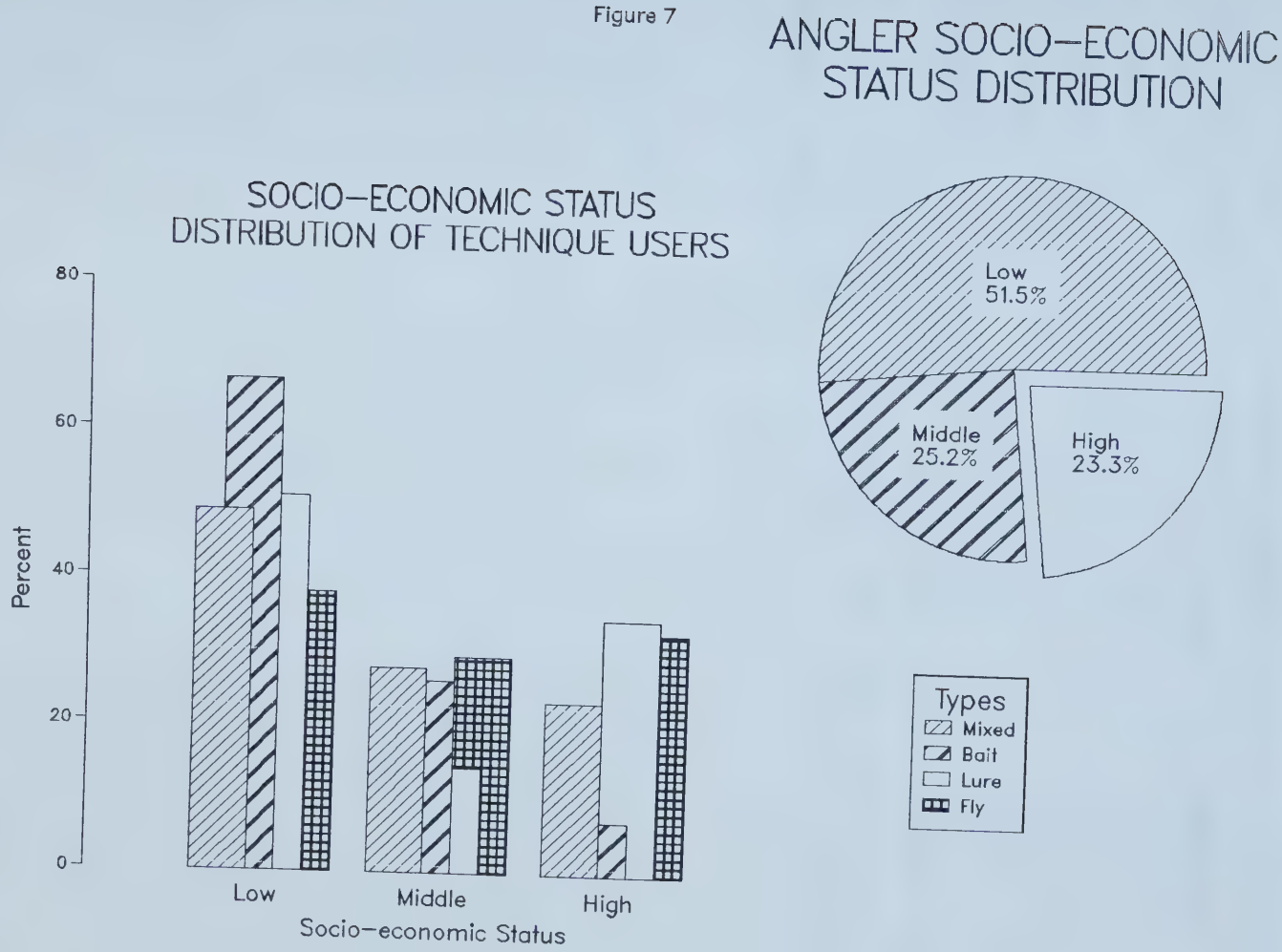

ANGLER SOCIO–ECONOMIC STATUS DISTRIBUTION
Low 51.5%
Middle 25.2%
High 23.3%
Types
Mixed
Bait
Lure
Fly
SOCIO–ECONOMIC STATUS DISTRIBUTION OF TECHNIQUE USERS
Percent
80
60
40
20
0
Low
Middle
High
Socio–economic Status

Table 11. Terminal Tackle Use by Angler Socio-economic Status.

Technique Use	Angler Socio-Economic Status			
	Lower	Middle	Upper	Total (%)
Non-specialists	32	38	34	34
Bait Specialists	34	27	8	26
Lure Specialists	18	10	27	18
Fly Specialists	16	25	31	22
Total (n)	137	67	62	266

Chi-square = 20.8; d.f. = 6; $p < 0.01$.

Anglers came from a diverse range of locations in the Province of Alberta. When asked to indicate whether they thought of themselves as coming from an urban or rural background, 51% stated that their background was urban while 47% indicated that their background was rural (2% felt they could not specify one background over the other).

Although the usefulness of measuring the background of anglers was limited, two interesting relationships were revealed. Anglers with a rural background preferred to catch several medium fish (74%) compared to 59% of anglers of an urban background (refer to Table 12). Anglers of a rural background preferred either limits or stocking practices predominantly (approximately 38% each), while anglers of an urban background seemed to be more divided with regard to their management strategy preference. While they strongly supported the use of limits (39%), they seemed to have less support for stocking (29%), and 16% more catch-and-release support (see Table 13).

Participatory Patterns of Anglers

Travel Commitment

Fifty-nine per cent of the sample lived in Alberta's three largest cities of Edmonton, Red Deer and Calgary, while 31% of anglers lived in smaller urban centers and rural locales in Alberta. The remaining 10% came from the western Canadian provinces and American origins.

Based on approximate mileages, it was found that the city residents of Edmonton, Calgary and Red Deer travelled an average drive of 579 km return to go fishing. (Total Trip Time = 5.8 hours/city angler). In Table 14 it can be seen that the rural anglers of the province travelled an average of 552 km return (Total Trip Time = 5.52 hours/rural anglers). The out-of-province anglers (10%) travelled an average drive of 1,500 km return (Total Trip Time = 15 hours).

A more representative, geographic breakdown combines the major cities with their respective regions and can be seen in Table 15. Within the province, the average number of kilometers travelled would be approximately 683 km per round trip - a driving time (at 100

Table 12. Preferred Fish Catch by Angler Background

Preferred Fish Catch	Background		
	Rural	Urban	Total (%)
Many Small	4	13	9
Several Medium	74	59	56
Couple of Large	22	28	25
Total (n)	125	135	260

Chi-square = 7.6; d.f. = 2; $p < 0.05$.

Table 13. Preferred Management Strategy by Angler Background.

Preferred Management Strategy	Angler Background		
	Rural	Urban	Total (%)
Stock	38	29	35
Limits	38	39	38
Catch-and-Release	8	24	17
Closures	13	8	10
Total (n)	114	118	232

Chi-square = 12.6; d.f. = 3; $p < 0.01$.

Table 14. Approximations of Average Mileage and Driving Time

Origin	Sample %	One-Way/km	One-Way Driving Time (Hours)
Edmonton	38.8	316	3.15
Red Deer	9.9	183	1.85
Calgary	9.9	292	2.9
N. Alberta	6.6	416	4.15
S. Alberta	20.7	233	2.1
C. Alberta	4.1	367	3.9
Out of Province	9.9	750	7.0

Table 15. Regional Breakdown of Average Mileage.

Origin	%	Return km	Total Mileage
Northern Alberta	45.4	832	91,520
Central Alberta	30.6	416	30,784
Southern Alberta	14.0	784	26,656
Out of Province	10.0	1500	36,000
	100.0	Maximum of:	184,960 kms

km/hour) of 6.83 hours. The approximate average kilometers travelled round trip would be 764 km (3.82 hours travel time each way).

From these approximate figures, it can be seen that the majority of anglers came from northern Alberta, more specifically the greater Edmonton area. Regional popularity of these fisheries is apparent since the second highest percentage was that of anglers from central Alberta. In general, it may be surmised that anglers were willing to travel for at least 6.75 hours and pay the related expenses of a 680 km trip. This depicts a significant commitment to their preferred leisure activity in terms of time and financial investments. The home origins of anglers utilizing locations of catch-and-release management programs are important so that pertinent messages are eventually targeted to population localities most effected by changes in management strategies.

Time Commitment to Angling

The average number of angler days fished per year was 25 (see Figure 8). Almost one-third of responding anglers said that they fished for more than 30 days a year. Close to one half of the anglers fished less than 20 days, while 18% fished a total of 20 to 30 days in the year (refer to Table 16).

Fly anglers were more likely to fish a minimum of 20 days in a year while lure anglers were almost the opposite. Fly anglers seemed to be highly motivated as far as their proportionate representation among the four categories of days fished - 43% fished more than 30 days. Bait anglers were also quite active as they had 38% who fished more than 30 days however when the same relationship was analysed for anglers who were primarily trout oriented, there was no statistical significance found.

Other associations revealed that those anglers who were least active relied heavily upon word of mouth information sources (61%) as did all other anglers. Another tendency appeared to show regular increases in the use of self-discovery methods as a general fishing information source; the most active anglers relying upon self-discovery methods as their

Figure 8

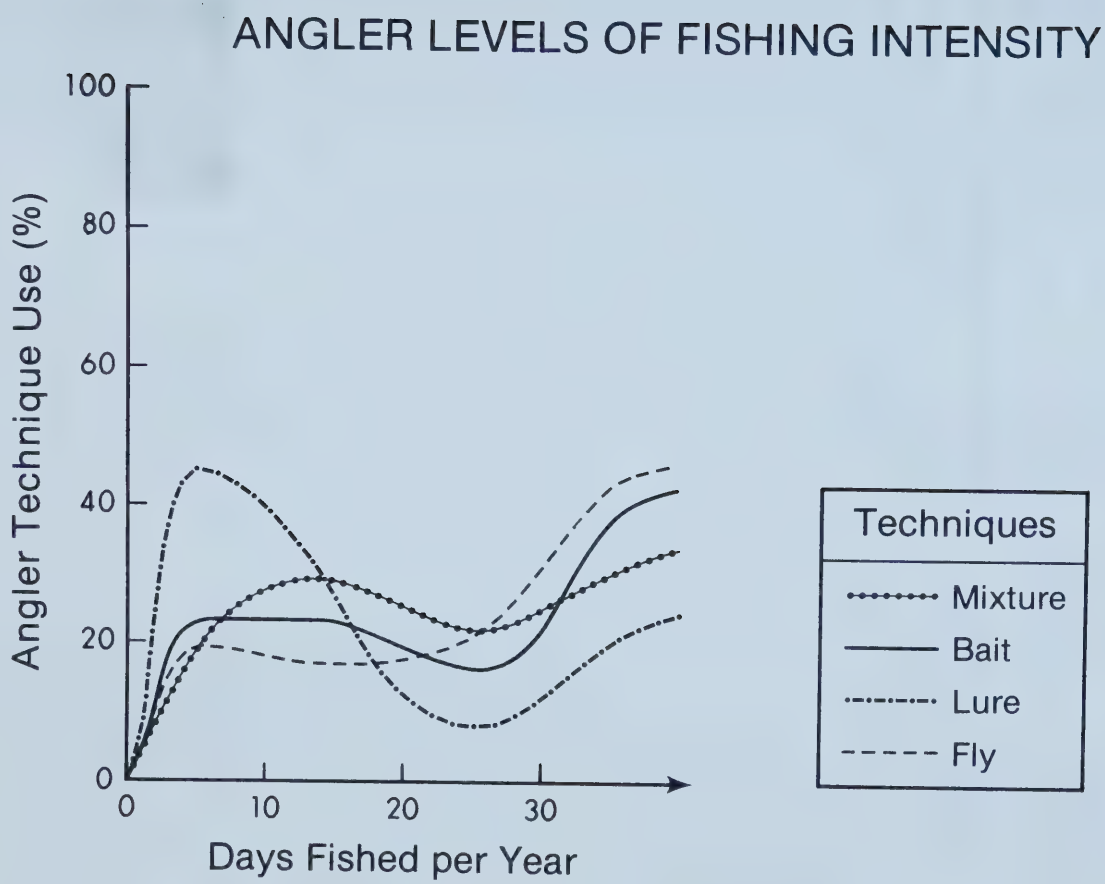

ANGLER LEVELS OF FISHING INTENSITY
Angler Technique Use (%)
100
80
60
40
20
0
0
10
20
30
Days Fished per Year
Techniques
Mixture
Bait
Lure
Fly

Table 16. Terminal Tackle Use by Angler Intensity (Days Fished/Year)

	Angler Intensity (Days Fished/Year) (%)				
Technique Use	Under 10	10 to 19	20 to 30	Over 30	Total (%)
Non-specialists	26	40	43	31	34
Bait Specialists	24	25	23	30	26
Lure Specialists	33	20	8	11	18
Fly Specialists	17	15	26	28	22
Total (n)	66	65	47	88	266

Chi-square = 21.0; d.f. = 9; $p < 0.05$.

source of general fishing information almost 24% of their time. Highly active anglers consulted mass media channels more than less active anglers (Chi-square = 19.3, d.f. = 9; $p < 0.05$).

It was also found that the most active (days fished/year) anglers tended to prefer limits first (58%); followed by stocking, catch-and-release programs and fishery closures as far as strategies for depleted fisheries (see Table 17). It is interesting to note that those anglers fishing less than 10 days in a year preferred the implementation of catch-and-release programs for depleted fisheries the most of any other angler category, while the most active anglers preferred catch-and-release programs the least (12%).

The data analysis regarding the degree of angling experience depicted an average of 20 years of experience, although the largest proportion of the anglers in this study had been fishing for between ten and nineteen years. This reflected the general socio-demographics of Albertans as far as their age distribution was concerned at the time of the field work (Statistics Canada 1981). Refer to Figure 9. The value of measuring the level of angler experience was revealed by the presence of many descriptive relationships.

Technique use by trout-oriented anglers seemed likely to vary in a predictable way as angling experience increased. The proportion of bait anglers decreased remarkedly after 20 years of experience (over a 30% change) and the proportion of lure anglers decreased by approximately half, but the proportion of fly anglers almost doubled. Another tendency evident in the data was that bait anglers were the predominant majority of the least experienced anglers in the sample (42%); while lure anglers composed the greatest proportion (41%) of anglers in the next highest experience category.

For anglers who had more than 20 years of experience, the predominant composition was of non-specialists (20 to 29 years: 29%; over 30 years: 21%) and fly anglers (20 to 29 years: 29%, over 30 years: 24%). See Table 18.

The data indicated that anglers with under ten years of experience are predominantly bait users whereas for anglers with more experience, more use is made of a mixture of tackles

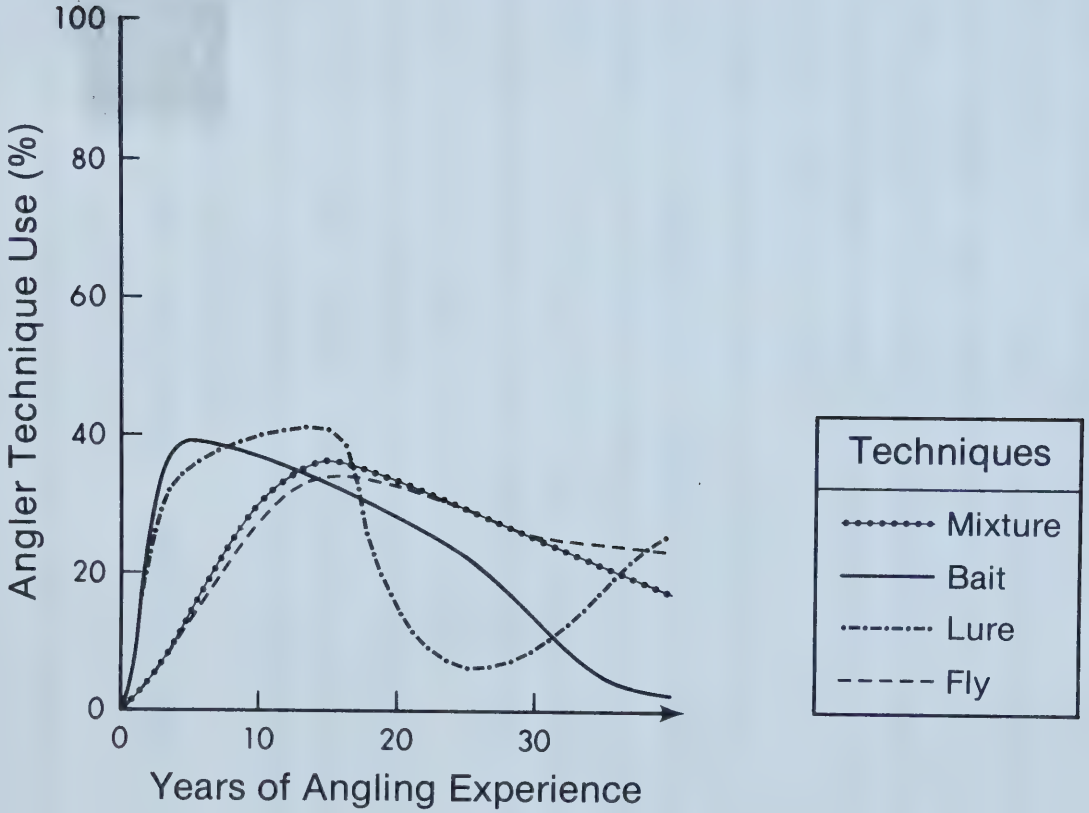
Table 17. Preferred Management Strategy by Angler Intensity (Days Fished/Year)

Preferred Management Strategy	Angler Intensity (Days fished/year)				
	Under 10	10-19	20-29	Over 29	Total (%)
Stock	43	39	44	20	35
Limits	16	34	36	58	38
Catch-and-Release	27	14	18	12	17
Closures	14	13	2	10	10
Total (n)	51	59	45	78	233

Chi-square = 31.2; d.f. = 9; $p < 0.001$.

Figure 9

ANGLER LEVELS OF FISHING EXPERIENCE



and flies than specializing in bait or lure tackle use. There is contradictory evidence regarding a natural progressive development toward fly fishing specialization with increasing experience since anglers with over 20 years of experience were almost as likely to be non-specialists as fly anglers. It may be that a significant proportion of trout-oriented anglers chose purposefully to remain flexible in their fishing technique to make the most out of their participation in their sport and the diversity of other sport fishes available in Alberta.

Although inexperienced anglers appeared to be less active as far as days fished per year (41% of the least experienced anglers fished less than 10 days during the year), a quarter of these anglers fished more than 30 days that year. For those anglers with at least 30 years of experience, the predominant proportion angled for more than 30 days the previous year (43%). For further details, please refer to Table 19.

Low socio-economic status anglers (52% of the entire sample) also tended to have less than twenty years of fishing experience (66%). Surprisingly, of all the least experienced anglers, there was more representation in both the high and low status levels (approximately 32% each) than in the intermediate status level (15%) which could mean that angling may initially be more appealing (but probably for different reasons) to novice anglers of either a high or low socio-economic status (Chi-square = 13.0; d.f = 6; $p < 0.05$).

Other statistically significant relationships of association occurred between the years of experience variable and the variables of general fishing information sources, preferred fish catch and resource knowledge. General relationships in associated data variables indicated that as the years of fishing increased, the following resulted.

1. As experience in years increased angler preference for catch size increased while the importance of a quantity catch decreased (see Table 20).
2. As experience in years increased anglers who had consistently relied upon word of mouth sources for general fishing information tended to rely more upon self-discovery techniques (Chi-square = 32.7; d.f. = 9; $p < 0.001$).
3. Anglers with more years of experiences tended to release fish. See Table 21 for details.

Table 18. Terminal Tackle Use by Trout Angler Experience.

Technique Use	Angler Experience (Years)				
	Under 10	10 to 19	20 to 29	Over 30	Total (%)
Non-specialists	22	34	38	40	34
Bait Specialists	42	22	21	7	23
Lure Specialists	17	12	3	10	10
Fly Specialists	19	32	38	43	33
Total (n)	56	78	72	60	167

Chi-square = 18.3; d.f. = 9; $p < 0.05$.

Table 19. Angling Intensity by Angler Years of Fishing Experience.

Active Days Fishing/Year	Angler Years of Fishing Experience				
	Under 10	10-19	20-29	Over 29	Total (%)
Under 10	41	17	26	18	25
10-19	27	24	25	22	24
20-30	7	22	22	17	18
Over 30	25	37	27	43	33
Total (n)	56	78	72	60	266

Chi-square = 19.0; d.f. = 9; $p < 0.05$.

Table 20. Angler Catch Preference by Years of Experience.

Fish Preference	Angler Years of Fishing Experience				
	Under 10	10-19	20-29	Over 29	Total (%)
Many Small	23	6	6	2	9
Several Medium	59	62	68	75	66
Couple of Large	18	32	26	23	25
Total (n)	56	76	72	60	264

Chi-square = 22.1; d.f. = 6; $p < 0.01$.

Table 21. Release Belief by Angler Years of Fishing Experience

Release Belief	Angler Years of Fishing Experience				
	Under 10 %	10-19 %	20-29 %	Over 29 %	Total %
Normally Releases	33	17	17	7	82
Does not Normally Release	67	83	83	93	18
Total (n)	55	76	70	60	261

Chi-square = 13.9; d.f. = 3; $p < 0.01$.

4. As experience in years increased there was a gradual increase in angler resource knowledge while a major decrease occurred in the number of experienced anglers having little or no resource knowledge (Chi Square = 10.3; d.f. = 3; $p < 0.05$).

Other Commitments

To a very limited extent, anglers were active in fish and/or wildlife organizations; most were not members (85%). Of the 15% who were members, 22% belonged to fly fishing groups (e.g. Federation of Fly Fishermen, Hook and Hackle Club, Alberta Fly Fishers), while the remainder were members of more diverse nature/environment groups (e.g. Alberta Fish and Game, Trout Unlimited, Edmonton Trout Club, Canadian Nature Federation, etc.).

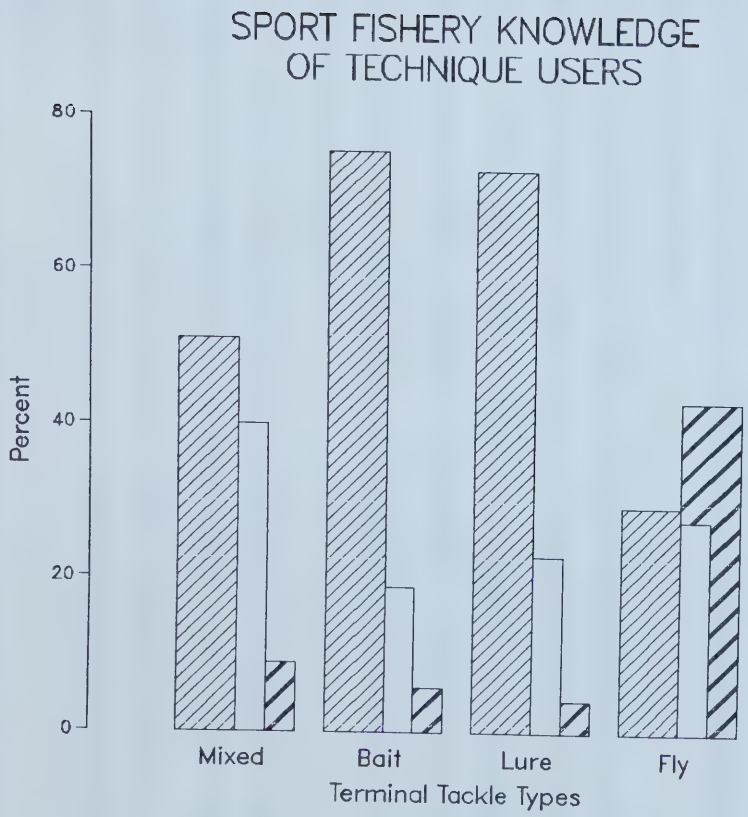
In a separate analysis, it was found that 18% of nonmembers could correctly identify more than half of the quiz species whereas members could correctly identify more than twice as many of the species by common name (Chi-square = 12.0; d.f. = 1; $p < 0.001$).

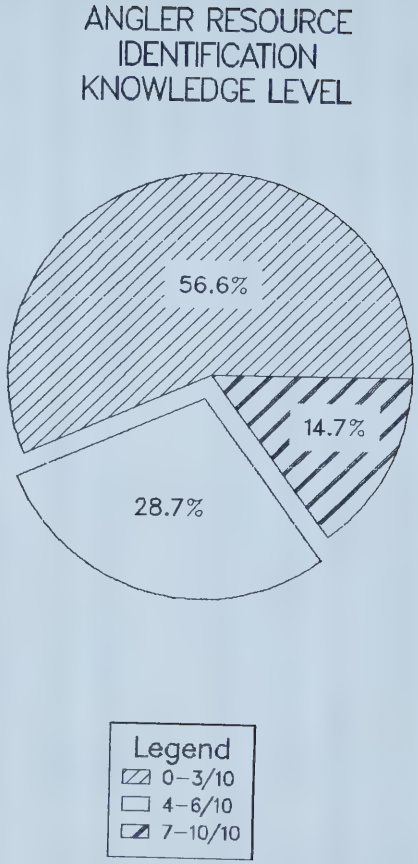
Anglers of the intermediate socio-economic status level were more likely to belong to a fish and/or wildlife organization than were anglers of other status levels (socio-economic status groups: low status - membership = 11%, intermediate status - membership = 27%, high status - membership = 13%; Chi-square = 9.2; d.f. = 2; $p < 0.01$).

Resource Familiarity of Anglers

A slight majority of anglers (57%) could not correctly identify four of the ten (5 fish, 5 aquatic invertebrates) items used to measure their identification skills and knowledge. Refer to Figure 10, and Table 22 and Table 23. These illustrations included the following species: *Salvelinus fontinalis* (eastern brook trout), *Salmo gairdneri* (rainbow trout), *Salmo clarkii* (cutthroat trout), *Stizostedion vitreum* (Mitchill), alias walleye; *Thymallus arcticus* (Pallas), alias arctic grayling; as well as the adult and nymphal forms of a mayfly (Order *Ephemeroptera*) and a stonefly (Order *Plecoptera*) and the adult form of a caddisfly (Order

Figure 10


SPORT FISHERY KNOWLEDGE
OF TECHNIQUE USERS
Percent
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types


ANGLER RESOURCE
IDENTIFICATION
KNOWLEDGE LEVEL
56.6%
14.7%
28.7%
Legend
0–3/10
4–6/10
7–10/10

Trichoptera).

Only 15% of all of the anglers correctly identified seven or more of the ten test items, and it became evident that the common trout food sources (invertebrates) were hardly known at all except by a few. All the fish illustrations were taken from a brochure produced by the Alberta Fish and Wildlife Division to inform anglers on the fishes of Alberta, which was distributed free of charge. These pictures were originally reproduced in "The Fishes of Alberta" (1st Edition) by Paetz and Nelson (1970) as an artist's conception of 'Sport Fish in Alberta' (pp. 273-281).

A significant relationship was found between trout-oriented anglers and their degree of resource knowledge, as evidenced in Table 24. Trout-oriented anglers were more likely to have a higher level of resource knowledge than anglers not oriented toward trout. Specifically, excepting all anglers with an intermediate resource knowledge level (who differed by only six percentage points), there was almost 20% variation between the resource knowledge level of trout-oriented and non-trout-oriented anglers.

Based on a two level progression of knowledge (under five items and over five items correctly identified), trout-oriented fly anglers had the highest percentage of more knowledgeable individuals (49%). Trout-oriented lure and bait anglers had the lowest percentage of more knowledgeable anglers (12% and 13% respectively (Chi-square = 17.8; d.f. = 3; $p < 0.001$). Surprisingly, non-specialists knew more about the fishery resource than either bait or lure anglers. Refer to Table 25.

Anglers may not necessarily progress from non-specialization to the sole use of one technique or from using only one technique directly to another, since if that were the case resource knowledge should have shown the same progression. Instead, anglers may continue to use more than one technique as an intermediate stage of development or as a culminating preference of technique use.

Many other associations were found which were statistically significant for all anglers. For example, anglers who were not members of a fish and/or wildlife group had only 18%

Table 22. Fish Species and Trout Food Sources Identified

Fish Species (Common Name)	Knowledgeable Anglers (%)
walleye	69.8
cutthroat trout	32.8
rainbow trout	83.4
brown trout	26.8
arctic grayling	43.8
Trout Food Sources (Common Name)	
adult caddisfly	14.0
adult stonefly	16.6
adult mayfly	41.9
stonefly nymph	16.6
mayfly nymph	20.0

Table 23. Angler Identification Knowledge Summary

Number of Fish Species and Trout Food Sources Correctly Identified	Degree of Anglers' Resource Identification Knowledge %	
	Fish Species	Trout Food Sources
0	7.2	53.6
1	18.9	20.8
2	25.7	6.8
3	20.0	7.2
4	15.1	5.3
5	13.2	6.4

Table 24. Resource Knowledge by Angler Trout Orientation.

Resource Identification Knowledge Level	Trout Oriented	Non-trout Oriented
0 to 3 correct	47%	72%
4 to 6 correct	31%	25%
7 to 10 correct	22%	3%
Total (n)	167	98

Chi-square = 22.2; d.f. = 2; $p < 0.0001$.

Table 25. Resource Knowledge by Technique Use of Trout Anglers.

Resource Knowledge	Trout Angler Technique Use				
	Mixed	Bait	Lure	Fly	Total (%)
Low (0 to 5)	71	87	88	51	70
High (6 to 10)	29	13	12	49	30
Total (n)	56	39	17	55	167

Chi-square = 17.8; d.f. = 3; $p < 0.001$.

who correctly identified more than five of the ten quiz items, whereas this degree of knowledge was held by more than twice that percentage of anglers (44%) who were members of such groups (Chi-square = 12.0; d.f. = 1; $p < 0.001$). Another significant association revealed that it was more likely for those anglers having previous catch-and-release experience to be knowledgeable (more than five of ten items identified correctly) about the fishery resource (Chi-square = 30.6; d.f. = 1; $p < 0.0001$).

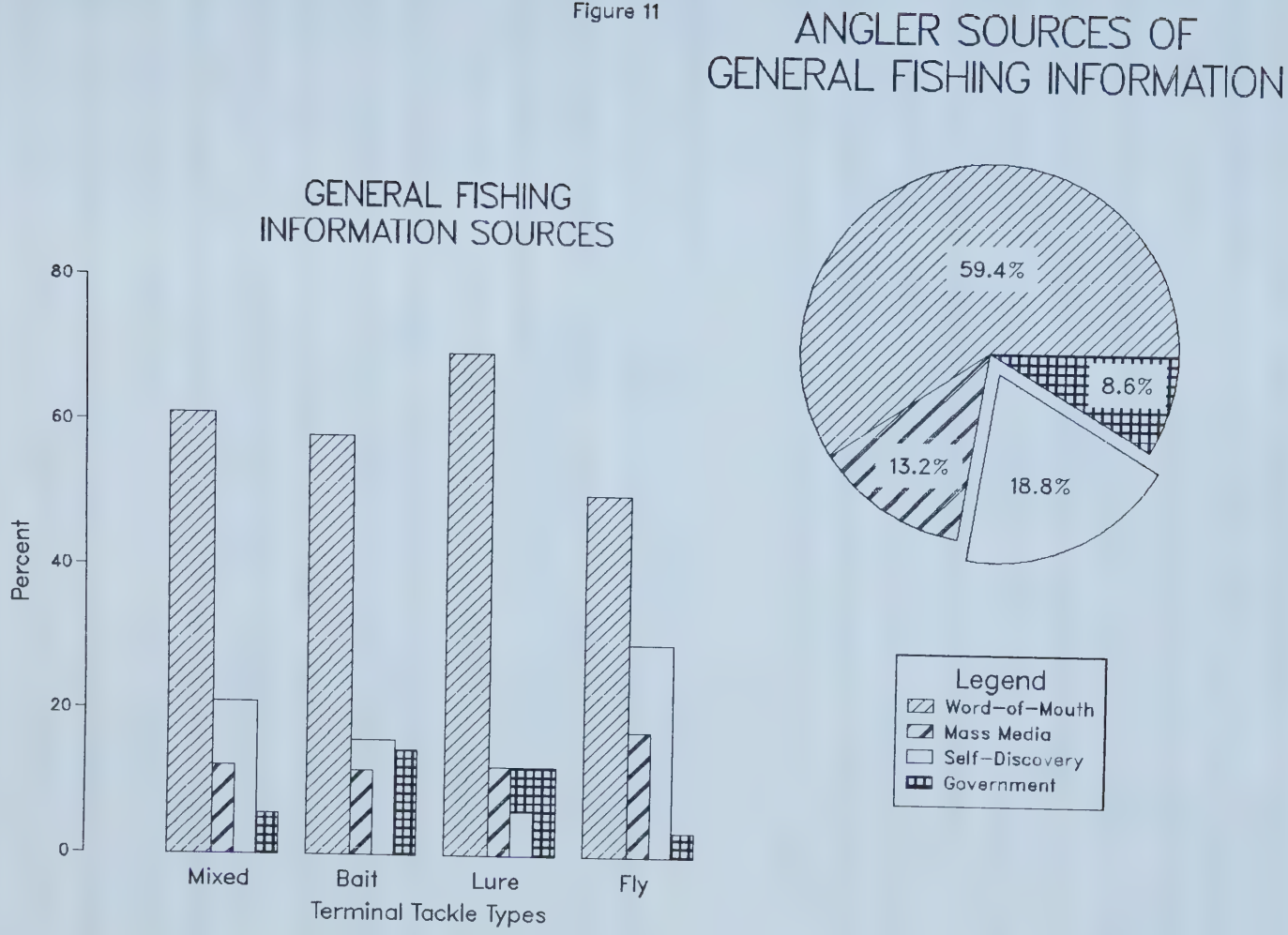
Other indirect associations were also found to occur as the level of resource knowledge held by anglers increased:

1. With increasing knowledge anglers were more likely to normally release fish (Chi-square = 8.4; d.f. = 2; $p < 0.05$).
2. With increasing knowledge anglers were more likely to prefer the implementation of limits and were also less likely to prefer stocking and closures. Surprisingly, their preference for catch-and-release programs remained constant (Chi-square = 26.2; d.f. = 6; $p < 0.001$).
3. With increasing knowledge anglers were more likely to prefer self-discovery methods of informing themselves about general fishing information and to rely slightly less on word of mouth information sources, although this was still the predominant information source (Chi-square = 18.7; d.f. = 6; $p < 0.01$).

Angler Communication Sources

The primary source of general fishing information used by anglers was their word of mouth channels, including family, friends, and other anglers (59.4%). Other sources consulted regularly by anglers included self-discovery methods and mass media channels (18.8% and 13.2% respectively). Governmental sources of general fishing information were used the least, in that Alberta Fish and Wildlife or Alberta Forest Service personnel or materials were consulted by only 8.6% of all anglers interviewed (see Figure 11).

Figure 11


ANGLER SOURCES OF
GENERAL FISHING INFORMATION
GENERAL FISHING
INFORMATION SOURCES
Percent
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
59.4%
8.6%
13.2%
18.8%
Legend
Word-of-Mouth
Mass Media
Self-Discovery
Government

Younger anglers tended to rely more on word of mouth general information channels, then on Alberta Fish and Wildlife sources, whereas the older anglers tended to rely equally on self-discovery techniques and word of mouth channels as their primary choice for fishing data (Chi-square = 43.4; d.f. = 9; $p < 0.0001$). Trout-oriented anglers' sources of general fishing information, varied among technique use types. Lure and bait specialists consulted government sources more than other anglers and fly specialists relied more on their own initiatives to discover such information, however, all anglers were heavily dependent upon word of mouth information sources, such as family, friends and business associates.

As expected the majority of anglers consulted the Alberta Fish and Wildlife Division (92%) when seeking regulatory information. Mass media sources and word of mouth were used by only 8% of anglers when seeking information about regulations (refer to Figure 12).

Angler Preferences and Beliefs

Analysis of the next few variables reflected a diverse range of angler preferences concerning catch composition, management strategies for depleted trout fisheries and what constitutes a quality fishing experience.

When defining a quality fishing experience, the predominant emphasis was on the quantitative and qualitative aspects of the catch (63%). Other non-biological aspects were deemed to constitute quality experiences, including environmental appreciation components (attractive scenery and natural surroundings, water quality, weather, etc.) at 21% and user-oriented (social) management components (availability of campsites, quality of facilities, accessibility, isolation and companionship) at 15%. When asked to rate these components further (second priority), anglers placed more emphasis on the environmental components (38%) as well as the social setting components (20%), with the catch-oriented aspects falling in perceived importance to 38% (refer to Table 26). For analysis, all attributes mentioned were categorized according to a consumptive or non-consumptive orientation (53% and 47% respectively).

Figure 12

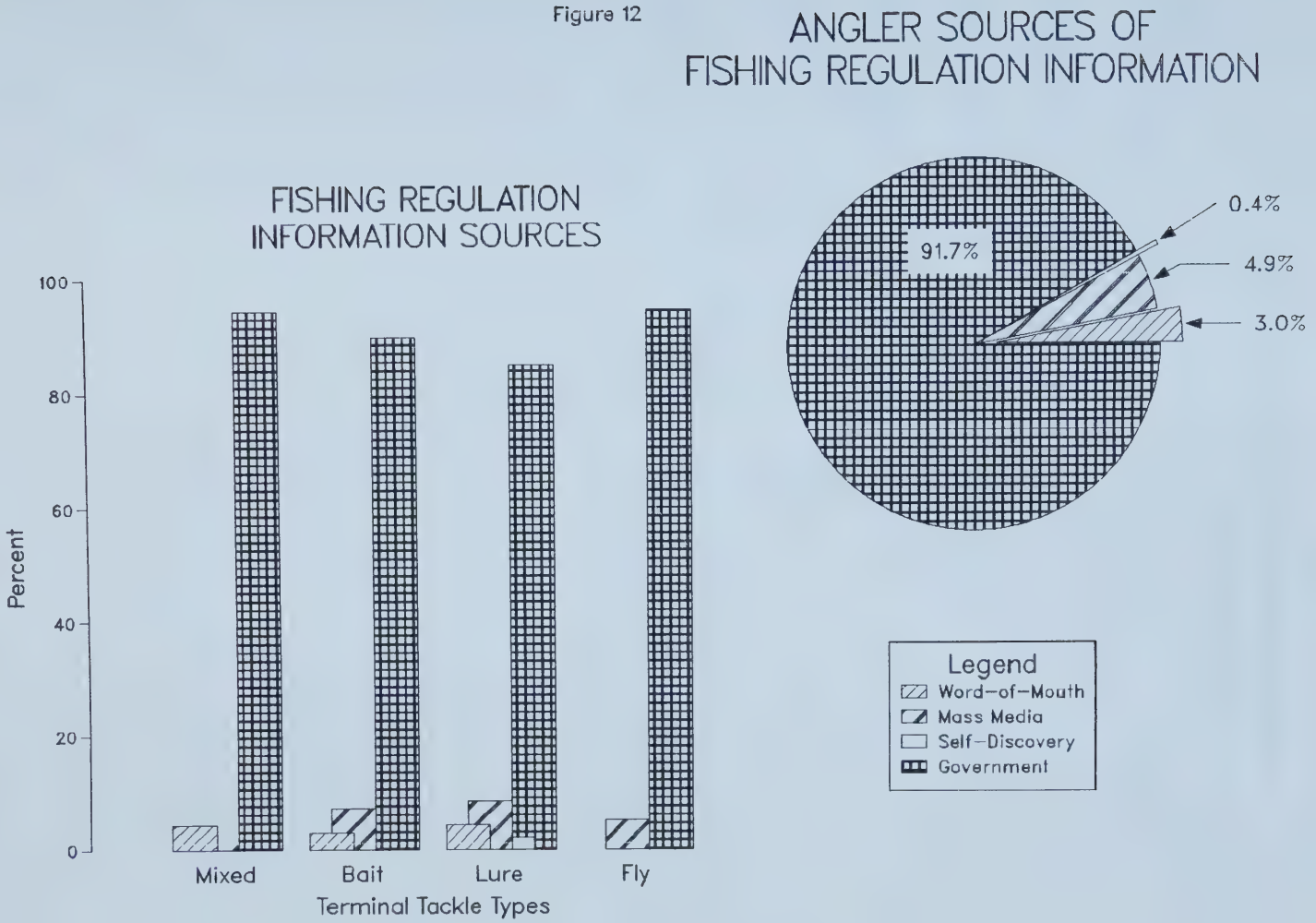

ANGLER SOURCES OF
FISHING REGULATION INFORMATION
FISHING REGULATION
INFORMATION SOURCES
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
91.7%
0.4%
4.9%
3.0%
Legend
Word-of-Mouth
Mass Media
Self-Discovery
Government

Table 26. Importance Ratings of Experiential Attributes

Experiential Attributes of Sport Fishing	Level of Importance (%)		
	Primary	Secondary	Tertiary
Quantitative Creel Components	51	27	26
Qualitative Creel Components	12	11	13
Environmental Setting Aspects	21	38	36
Social Setting Aspects	15	20	21
Other	1	4	4
Total (%)	100	100	100

While there were anglers who definitely preferred to catch a couple of large fish (25%), and there were others who preferred to catch many small fish, most trout anglers preferred to catch several medium fish (66%). This is understandable, since it is the usual middle compromise. Their reasons were for the action inherent in the frequency of catch and for the adequate creel of good tasting fish for consumption. See Figure 13.

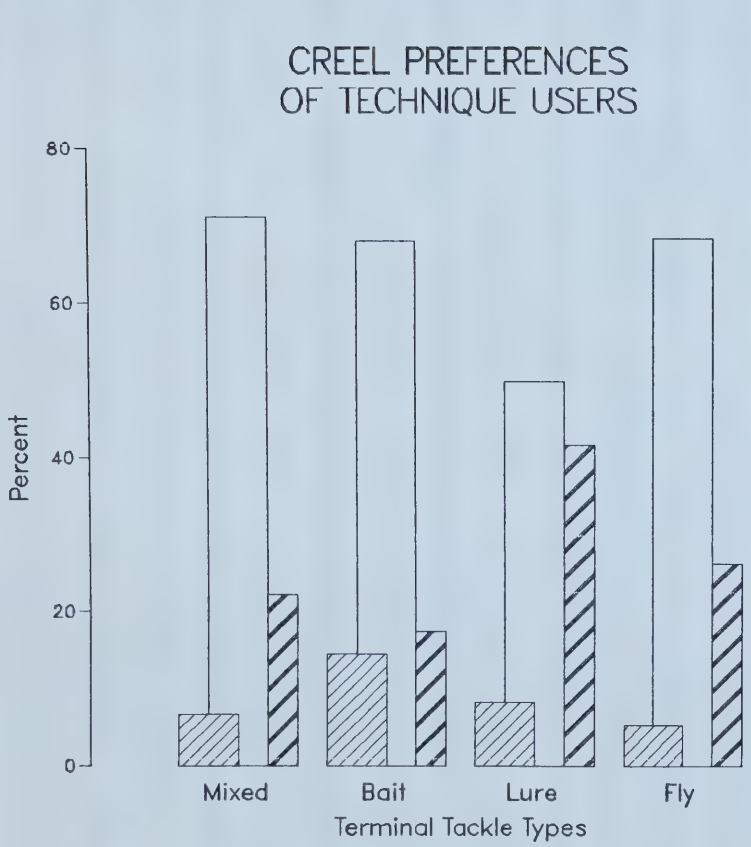
Lure specialists preferred to catch a couple of large fish (42%) more than other specialists (bait: 17%, fly: 26%); bait specialists preferred to catch many small fish (15%) more than other specialists (lure: 8%, fly: 6%), but all angler types still favoured a catch of several medium fish (bait: 68%, lure: 50%, fly: 60%). Lure fishermen appeared to be the most trophy oriented in their angling objectives.

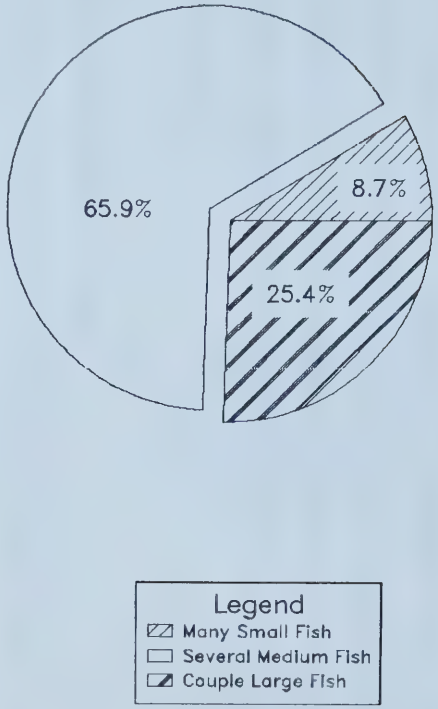
There was one other relationship of statistical significance found with this preference variable when the analysis was conducted. This relationship will serve to introduce the next variable to be discussed - anglers' preference of management strategies for depleted trout fisheries. Here again, the responses to an open-ended question were broadly grouped into four categories including : limits (e.g. seasonal and species limits, creel - daily and possesion limits); closures/refuges; stocking programs; catch-and-release programs (e.g. slot length release, no kill catch-and-release for whole fisheries or segments thereof).

Most anglers who preferred to catch a couple of large fish were more likely to favour catch-and-release management (28%) than anglers who preferred a different catch. However, these same anglers were also more likely to select stocking as a management strategy and were also less likely to support the implementation of limits. Conversely, anglers who preferred many small fish as a catch, although almost as supportive of catch-and-release management techniques (20%), were more likely to favour the implementation of limits (45%) and then stocking practices (35%) and closures not at all. It appeared that the opportunity to fish played a role in anglers' preference selection criteria. The predominant majority of all anglers preferred to catch several medium fish and their trout fishery management preferences seemed to reflect a compromise between other anglers' preference perceptions.

Figure 13

ANGLER CREEL PREFERENCES : FISH QUANTITY AND SIZE





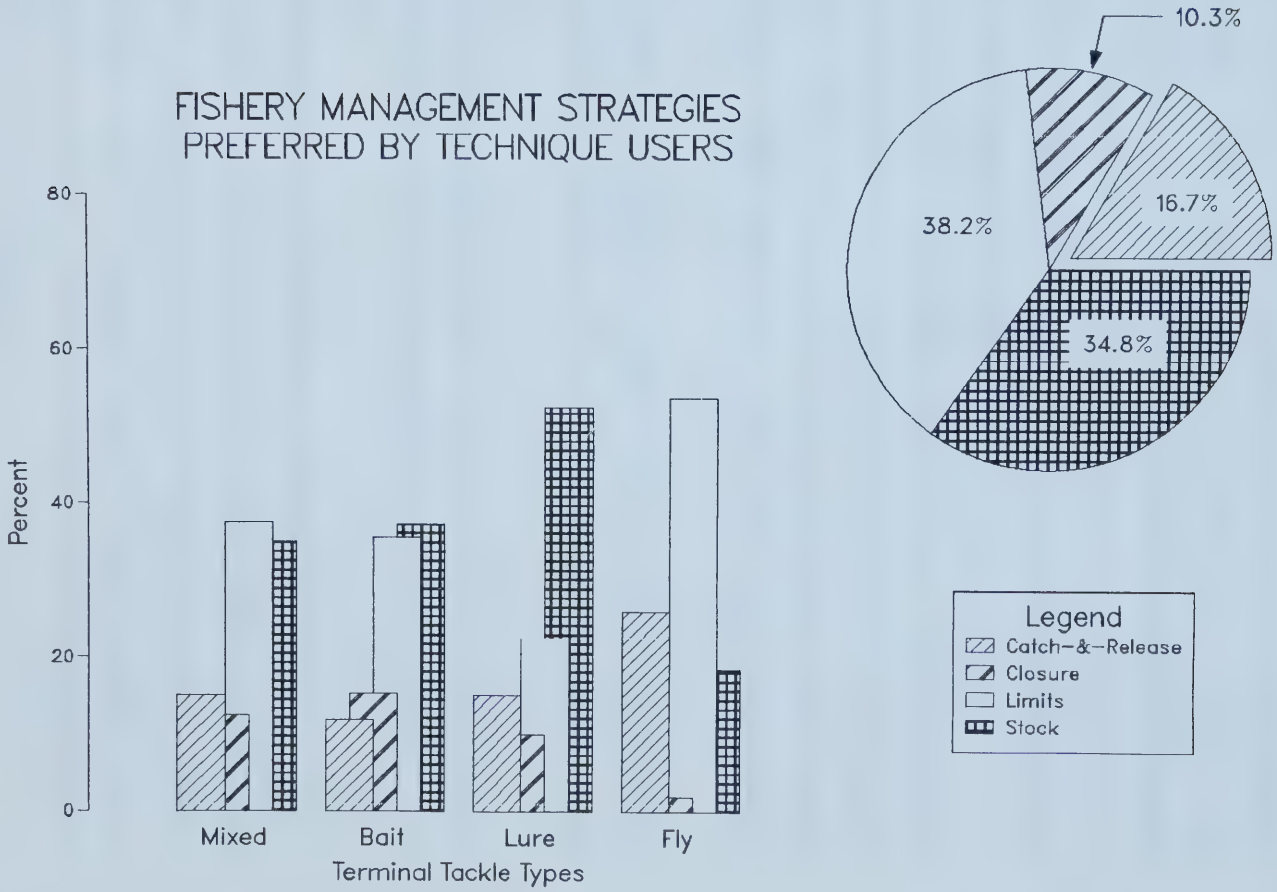
Anglers were virtually evenly divided between the implementation of size/catch/season limits (38%) and stocking (35%) for depleted trout fisheries (see Figure 14). It is interesting that almost 17% of respondents preferred to see some form of catch-and-release, or a combination of other management strategies in conjunction with catch-and-release regulations. Approximately 10% of anglers interviewed preferred to see fishery closures rather than any of the other strategies. Other management alternatives identified included stricter enforcement, reducing access, alternate year closures and tailored combinations of stocking, closures and reduced limits.

Angler Exposure to Catch-and-Release Fishing

It was necessary to find out what percentage of the entire sample had experienced angling under a catch-and-release regulation elsewhere so that comparisons could be made between those anglers with or without previous program participation. As well, this narrowed down the identification process of describing the most receptive portion of the sample, since they had the most awareness and interest in the catch-and-release program. These individuals would probably be the earliest portion of anglers to go through the entire decision-making process in Alberta, perhaps culminating with their adoption of the catch-and-release program before the predominant majority of anglers arrive at the interest stage of evaluating it. In Rogers and Shoemaker (1971), the distribution of a population's adoption rate follows the normal bell curve which identified the initial sixteen per cent as being 'innovators' (2.5%) and 'early adopters' (13.5%). The 'early majority' (34%), 'late majority' (34%) and the 'laggards' (16%) followed in sequence as far as their speed of adoption and acceptance of the innovation. By finding out what percentage of the sample had previous experience, the researcher was able to approximate in a preliminary manner, the extent of angler catch-and-release participation, which may have indicated the receptivity of anglers toward this innovative program at that time.

ANGLER PREFERRED FISHERY MANAGEMENT STRATEGIES

Figure 14



Eleven per cent of the anglers interviewed had fished under a catch-and-release program elsewhere. This was quite a few more anglers than anticipated. Most anglers had experienced fishing under catch-and-release regulations when they went south to Montana (45%) and Yellowstone National Park (22%), or to British Columbia (15%). It was determined that anglers who were fly specialists had the highest percentage of experienced catch-and-release individuals (29%), while both bait and lure anglers were relatively inexperienced (3% and 2% respectively). Eleven per cent of non-specialists had experienced catch-and-release programs elsewhere (Chi-square = 25.1; d.f. = 3; $p < 0.0001$).

It was found that trout oriented anglers were more likely to have had previous catch-and-release experience (15%) than those who were not trout-oriented (5%) (Chi-square = 4.6; d.f. = 1; $p < 0.05$). The data analysis revealed that as angler levels of resource knowledge increased, more anglers tended to have catch-and-release program experience (see Table 27).

Evidently, anglers who tried catch-and-release programs previously were more likely to have a high resource knowledge level than any other level (High: 38%, Intermediate: 11%, Low: 4%).

Anglers composing the majority of those with previous catch-and-release experience were fly anglers (55%) although 35% of these experienced anglers were non-specialists as can be seen in Table 28.

As revealed in this review of the characteristics, preferences and participatory patterns of anglers in the Nordegg area, there is a broad variability found within the angling social system. The existence of important differences in angler perspectives and behaviour amongst terminal tackle typologies confirms the relevance of using this biological criterion for defining variations among anglers and provides a viable and worthwhile method for understanding the human dimensions of sport fisheries management.

Table 27. Catch-and-Release Experience by Angler Resource Knowledge.

Catch-and-Release Experience	Degree of Resource Knowledge (%)			
	Low	Intermediate	High	Total (%)
No	96	89	62	89
Yes	4	11	38	11
Total (n)	146	71	39	256

Chi-square = 36.2; d.f. = 2; $p < 0.0001$.

Table 28. Terminal Tackle Use by Angler Previous Catch-and-Release Experience.

Technique Use	Previous Catch-and-Release Experience		
	Inexperienced	Experienced	Total (%)
Non-specialists	34	35	34
Bait Specialists	28	7	25
Lure Specialists	21	3	19
Fly Specialists	17	55	22
Total (n)	227	29	256

Chi-square = 25.1; d.f. = 3; $p < 0.0001$.

D. Receptivity of Sport Anglers to the Catch-and-Release Trout Management Program

The chapter describing adoption theory identified five different characteristics of any innovation: relative advantage, compatability, complexity, trial potential and observability. Since there were no other catch-and-release programs in effect in Alberta, the characteristic concerning "observability" did not have any merit for inclusion in this analysis. Therefore, all the questions regarding the catch-and-release trout management program covered four major attributes of the catch-and-release innovation. In this section, each of these four catch-and-release innovation characteristics will be addressed by reviewing each individual attribute and by detailing the results of the individual survey questions administered in the field. The rationale for the weighting of each of the attributes and its utility has been explained in the study methods. Thus a cumulative measure of the utility of the catch-and-release program to each angler may be defined and examined for relevance to the terminal tackle profile variables previously described.

The Characteristics of Catch-and-Release as an Innovation

Four different aspects of the catch-and-release program were identified from the related literature about innovations. These are seen as being directly applicable to the Alberta catch-and-release situation and form the basis upon which the angler responses to this innovative program were analysed. Following is a brief review of the characteristics' definitions within this natural resource management context.

Each of the following ten study questions used in the investigation concerned themselves with angler response to the catch-and-release innovation. They are organized according to each of the four innovation characteristics stated below.

Relative Advantage

Defined as the degree to which an innovation is perceived as better than the previous practice, relative advantage may be interpreted differently by an individual angler or by the

trout anglers' social system. It seemed that the catch-and-release program provided benefits to anglers since it allowed for the continued enjoyment of the fishery's aesthetic resources while still providing the thrill of the catch. However, since the adoption of an innovation is an individual decision, subjects in the survey were asked about their perception of the catch-and-release trout management program in three particular ways with regard to its perceived relative advantage.

1. Is the catch-and-release trout management program a worthwhile idea?

The overwhelming majority of all anglers who responded thought that the catch-and-release program was worthwhile (90%). This was not a statistically significant association when cross tabulated with the technique use of anglers. However, for purely descriptive purposes, a subsample breakdown of how anglers in this sample responded to this question according to their use of terminal tackle has been included (see Figure 15).

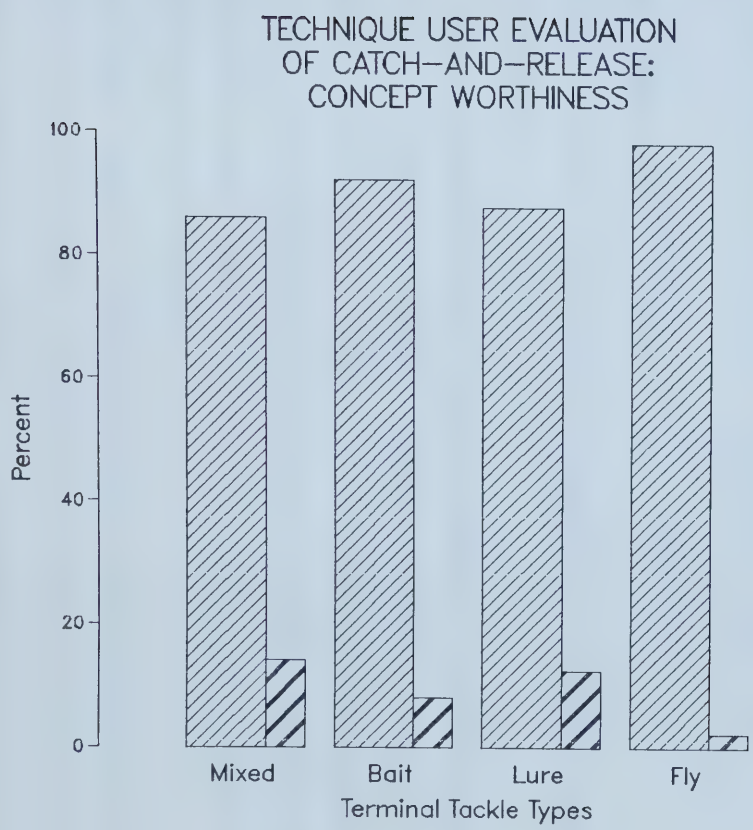
2. Would you be attracted to a catch-and-release stream?

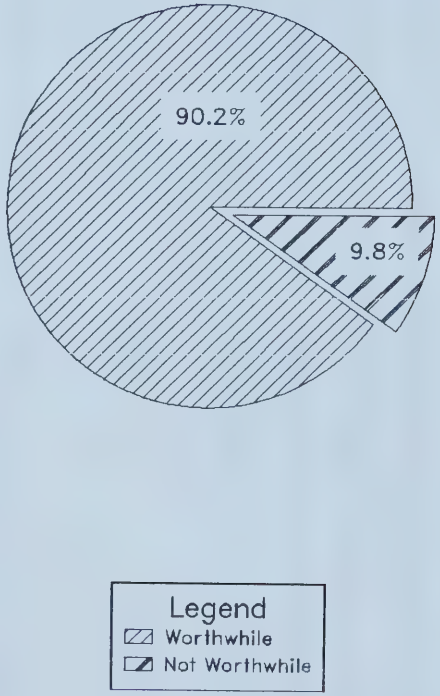
While the majority of all anglers who responded were not particularly attracted, close to 46% asserted that the catch-and-release trout management program attracted them. When this variable was cross tabulated with angler terminal tackle use a statistically significant association was found (Chi-square = 8.1; d.f. = 3; $p < 0.05$). Fly fishermen differed the most in their degree of attraction from other terminal tackle types with a variation of approximately 22% more being attracted (61% were attracted compared to 39% who were not attracted). Mixed tackle users had the second highest degree of attraction in that 48% were attracted, whereas bait and lure anglers had only 37% who were attracted by a catch-and-release fishery.

3. Should the catch-and-release trout management program be expanded in Alberta?

Figure 15

EVALUATION OF CATCH–AND–RELEASE: CONCEPT WORTHINESS





As a management tool the majority of anglers who responded were in support of expanding the catch-and-release program (87%). When this variable was cross tabulated with the terminal tackle types, again no statistically significant association was revealed. For descriptive purposes only a subsample breakdown of angler response to this question is included (see Figure 16). About 29% of supportive anglers thought that the program should be used as a management tool to ensure recreational quality, whereas 20% felt that the program would be best utilized as a preventive management tool to protect sport fisheries from depletion.

Compatability

This has been defined as the degree to which an innovation (e.g. the catch-and-release program) is perceived as being consistent with the existing values, past experiences and needs of the receivers. Here, three questions were deemed to be appropriate measures.

4. Do you normally release fish?

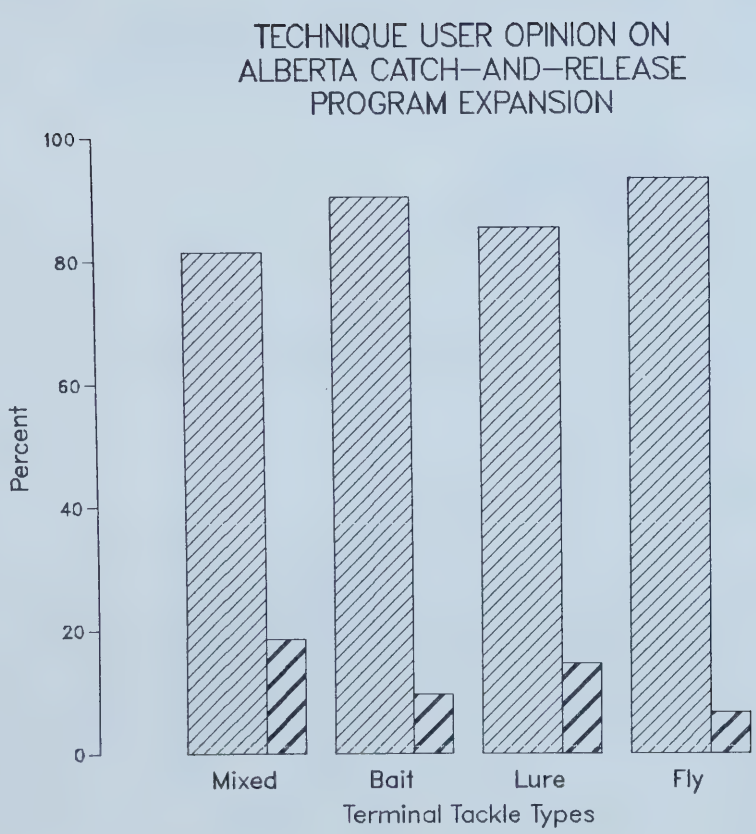
The predominant majority of all anglers who responded said that they did indeed normally release fish (82%).

When a subsample analysis was done of the angler response to whether fish were normally released and the terminal tackle types, a statistically significant association was revealed (Chi-square = 10.6; d.f. = 3; $p < 0.05$). The major variation in this association existed between how fly and bait anglers responded about their release ethic: 92% versus 72% respectively said that they normally released fish. Lure anglers (88%) and mixed tackle users (80%) said that they also normally released fish.

In Figure 17 angler response to this question has been labelled as their stated release belief (ethical belief). A second response has been added to this graph, namely the subtracted difference between what anglers said they caught in terms of numbers of fish and what they kept for their creel during that particular fishing trip. This second response has been labelled

Figure 16

OPINION ON CATCH–AND–RELEASE PROGRAM EXPANSION IN ALBERTA



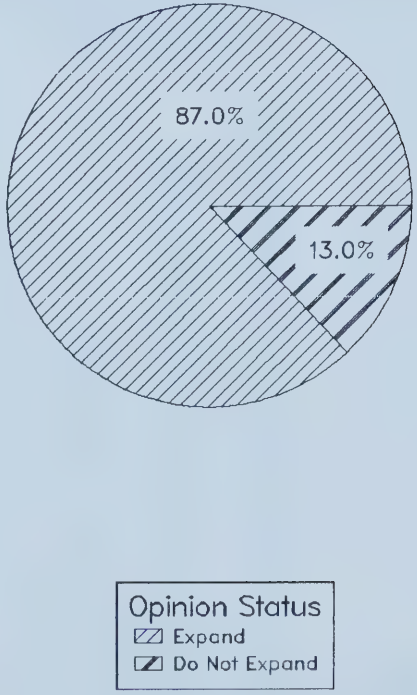
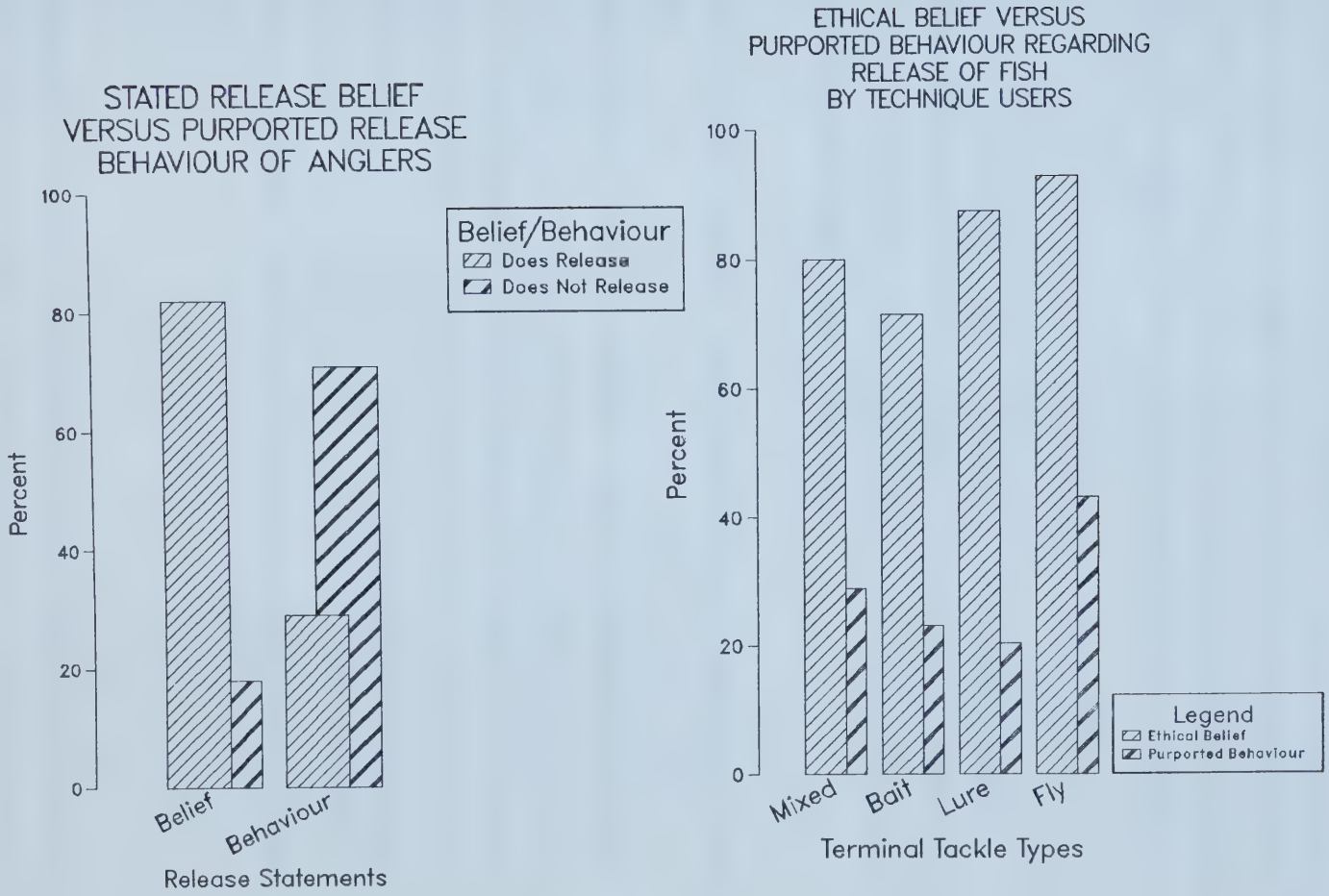


Figure 17


STATED RELEASE BELIEF
VERSUS PURPORTED RELEASE
BEHAVIOUR OF ANGLERS
Percent
100
80
60
40
20
0
Belief
Behaviour
Release Statements
Belief/Behaviour
Does Release
Does Not Release
ETHICAL BELIEF VERSUS
PURPORTED BEHAVIOUR REGARDING
RELEASE OF FISH
BY TECHNIQUE USERS
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
Legend
Ethical Belief
Purported Behaviour

as their purported release behaviour. It can be seen that there is an evident variance between angler release belief and their purported behaviour. Therefore this result casts doubt upon the reliability of the high percentage of anglers who say that they normally release fish. In order to more accurately determine the truth of the matter, an angler would have to be observed fishing and then also interviewed to verify the degree of reliance that could be placed on his statement.

5. Have you previously tried fishing under a catch-and-release trout management program?

As indicated previously, only 11% of all anglers interviewed had tried fishing where a catch-and-release trout management program had been in effect. The subsample breakdown is detailed in a table elsewhere in this chapter and in Figure 18.

6. Do you think the North Ram River should remain under the catch-and-release program permanently?

Only 36% of all the anglers who responded agreed with permanent implementation of the catch-and-release program on the North Ram River. In Figure 19 the subsample breakdown of terminal tackle use and their response to a permanent catch-and-release program on the North Ram River is described. This was found to be a statistically significant association (Chi-square = 9.7; d.f. = 3; $p < 0.05$), with fly anglers being the most favourable toward a permanent program (54%), followed by mixed tackle users (32%), bait anglers (29%) and lure anglers (28%). Refer to Figure 19 for a visual comparison of angler support.

Complexity

Complexity has been defined as the degree to which an innovation is perceived as difficult to understand and use. Here the integral aspect is really the comprehension of catch-and-release programs are needed as a management tool. As well, some measure of

Figure 18

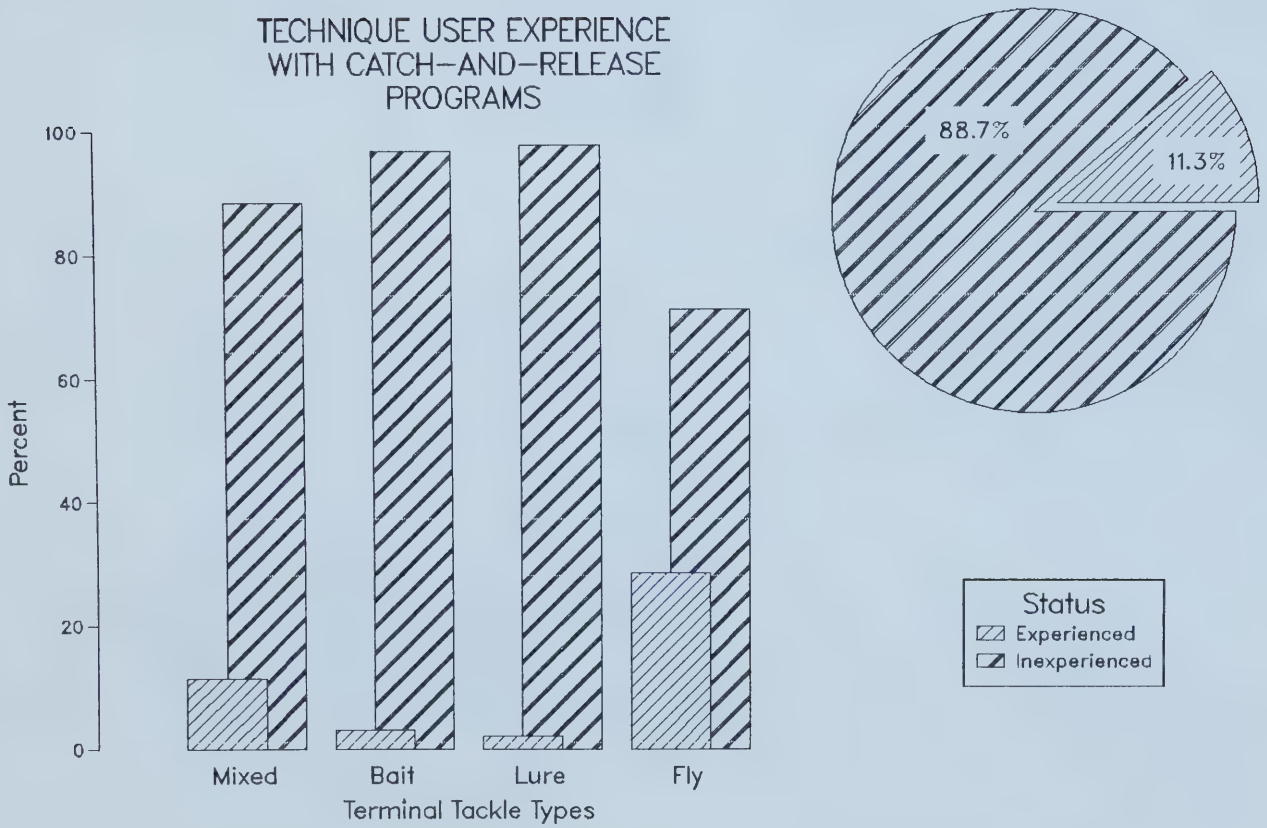
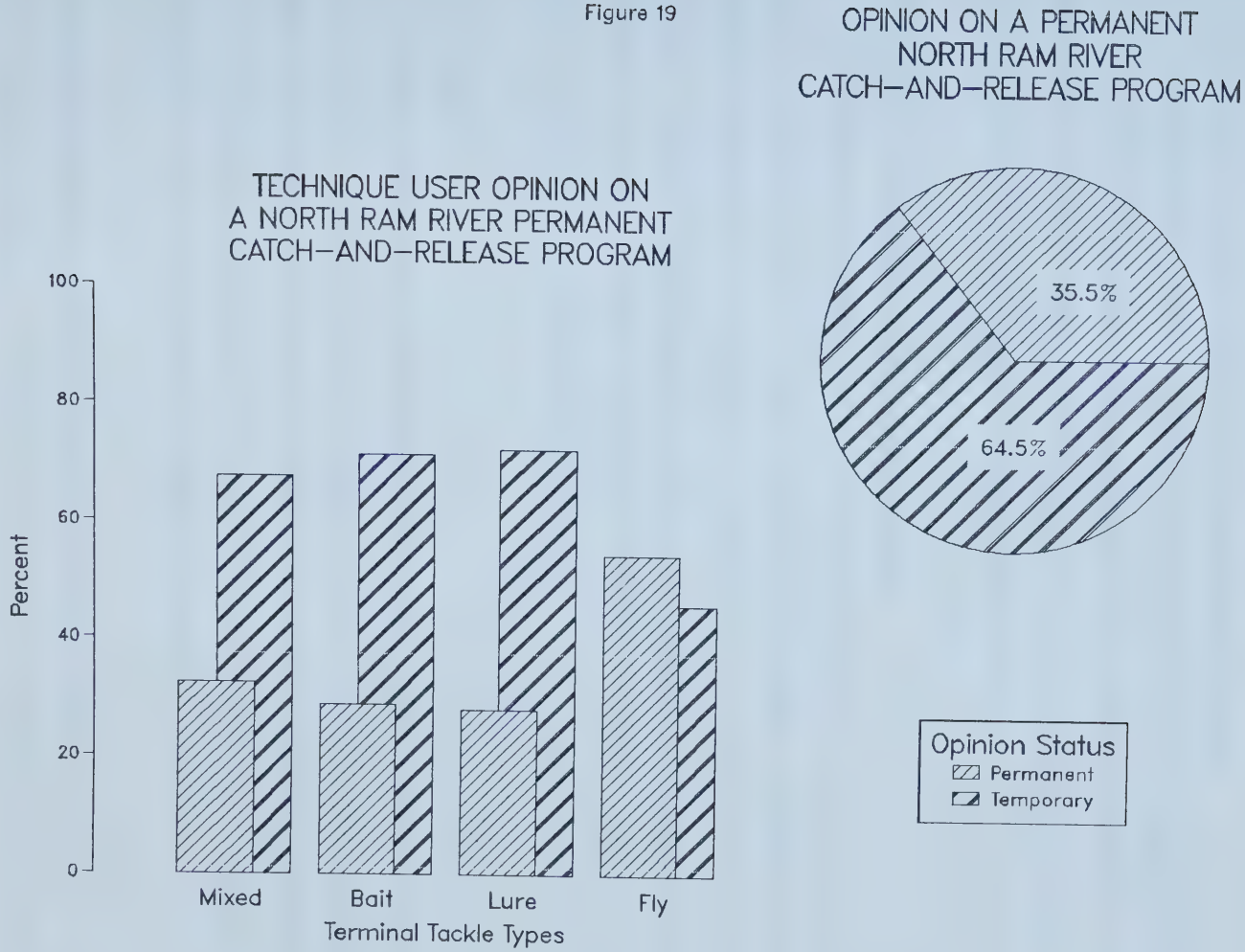

TECHNIQUE USER EXPERIENCE
WITH CATCH–AND–RELEASE
PROGRAMS
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
PREVIOUS ANGLER EXPERIENCE
WITH CATCH–AND–RELEASE PROGRAMS
88.7%
11.3%
Status
Experienced
Inexperienced

Figure 19


TECHNIQUE USER OPINION ON
A NORTH RAM RIVER PERMANENT
CATCH–AND–RELEASE PROGRAM
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
OPINION ON A PERMANENT
NORTH RAM RIVER
CATCH–AND–RELEASE PROGRAM
35.5%
64.5%
Opinion Status
Permanent
Temporary

determining the level of knowledge held by an angler regarding the act of releasing a fish was required. Accordingly, two questions were designed and addressed to the sample.

7. Could you explain your understanding of the catch-and-release program?

It was apparent that some anglers who responded were not as knowledgeable about the catch-and-release trout management program rationale as were others since only 42% of the sample had a full understanding of the program. There was no statistically significant association found between the terminal tackle types and this variable.

8. Can a fish be released without being seriously damaged?

The predominant majority of anglers who responded thought that the release of a fish was not a damaging act (92%). Of course, this does not fully reflect the individual's actual knowledge or experience with releasing fish, but at least the perception exists that the skill can be learned, and that it is not necessarily too complex, since almost all of the anglers indicated that they had released fish before. There was no statistically significant association found between the terminal tackle types and this variable either.

Trial Potential

Finally, trial potential has been defined as the degree to which an innovation may be experimented with on a limited basis. As mentioned previously, catch-and-release has a high degree of trial potential since anglers have always had the option of voluntarily releasing fish on all non-mandatory catch-and-release fisheries. For the intent of this survey, two questions were designed and administered in order to measure trial potential.

9. Would you be willing to try fishing at a catch-and-release sport fishery?

Seventy-seven per cent (77%) of those anglers who responded felt that they would be willing to try angling at a catch-and-release sport fishery. Although there was no association

revealed of statistical significance in the subsample breakdown of terminal tackle use of anglers and this particular variable, it was deemed of interest to depict this graphically in Figure 20.

10. Do you agree with the experimental catch-and-release program on the North Ram River?

A large majority of anglers who expressed an opinion agreed with the North Ram River catch-and-release trout management experimental program (89%). No statistically significant association was found between this variable and the subsample breakdown according to angler terminal tackle use, although the responses are depicted in Figure 21 for descriptive purposes only.

The Relationship Between Technique Use and Angler Support of the Catch-and-Release Innovation

In the preceding material a cumulative measure of utility was developed so that there would be some manner in which to test the hypothesis that the degree of angler acceptance of catch-and-release is associated with the predominant use of a certain type or types of terminal tackle. Accordingly, this section will attempt to examine any relationships found in common between terminal tackle use and the degree of trout angler acceptance found in this study. As well, these will be tested in order to examine and validate the assumption that terminal tackle users who have progressed in their development toward the complex end of the angling continuum (i.e. fly specialists) are more likely to be more receptive of the catch-and-release innovation than other anglers (non-specialists, bait and lure anglers).

The major result of this analysis is that there is indeed a significant relationship between anglers' trout orientation in combination with their technique use and their degree of support for the catch-and-release program as can be seen in Table 29. There is more evident support for the program by the trout-oriented fly and lure angler types at both the medium and high support levels (approximately equal at 85% versus 82% respectively). The

Figure 20

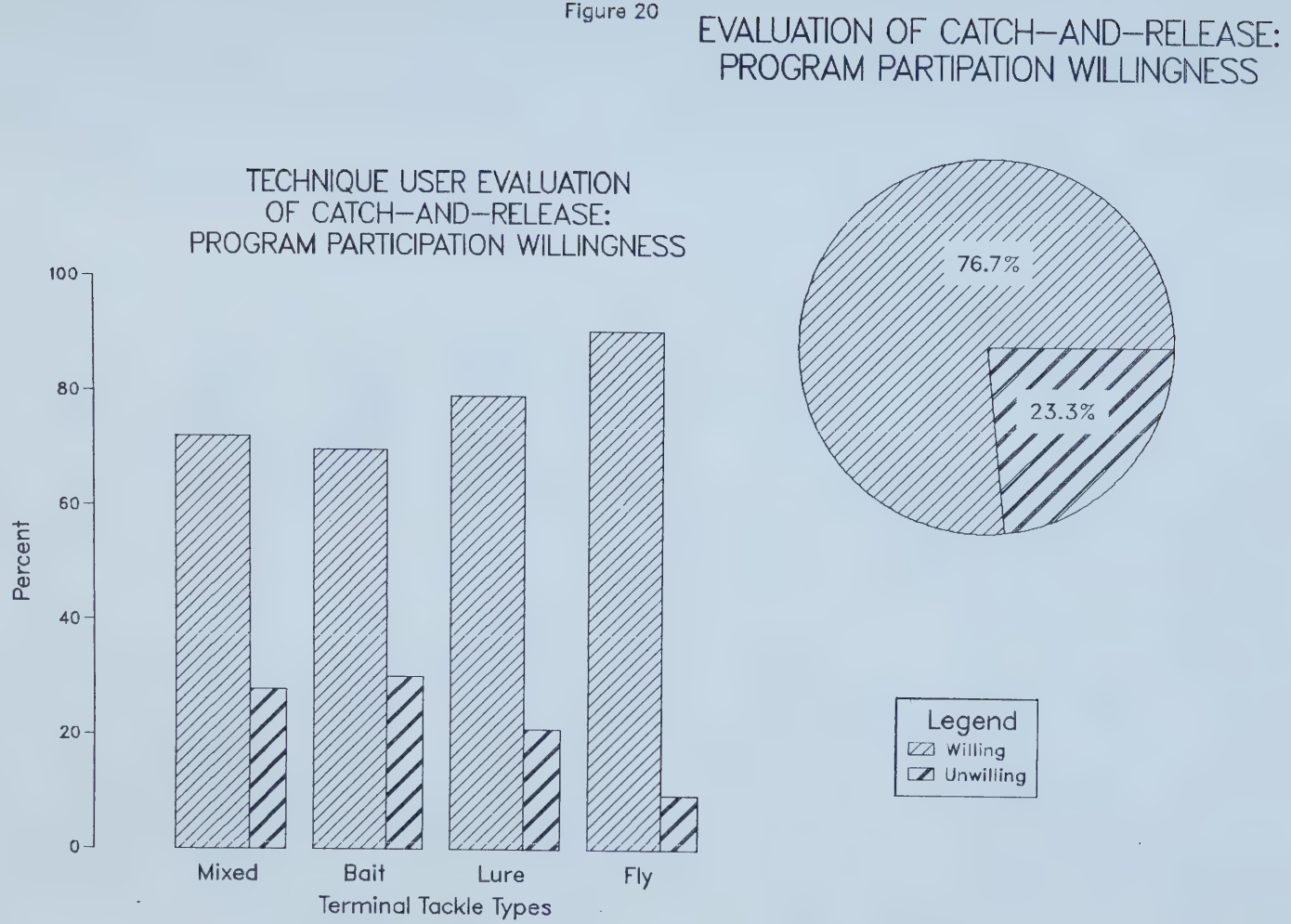
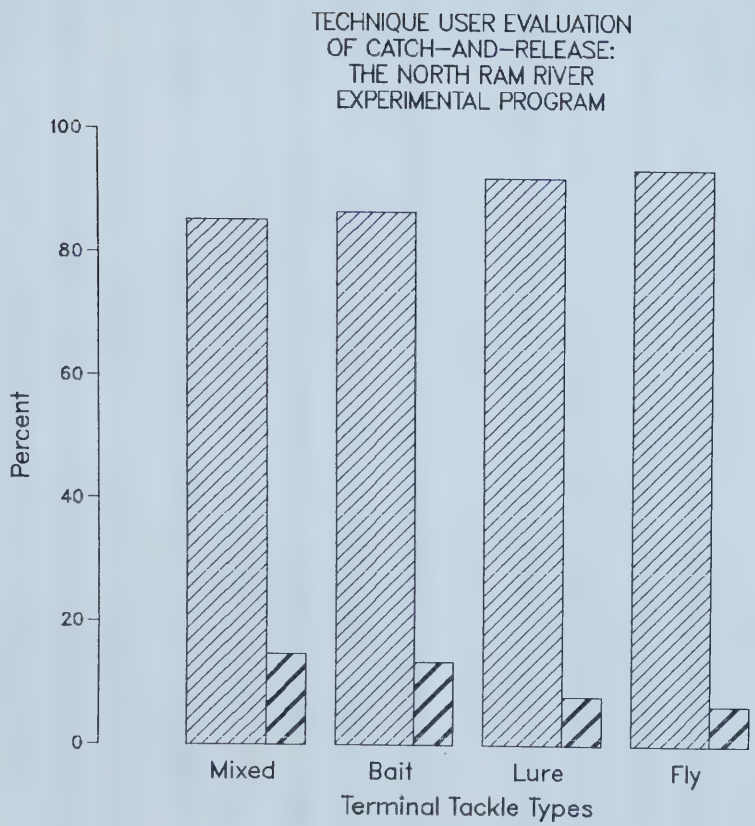
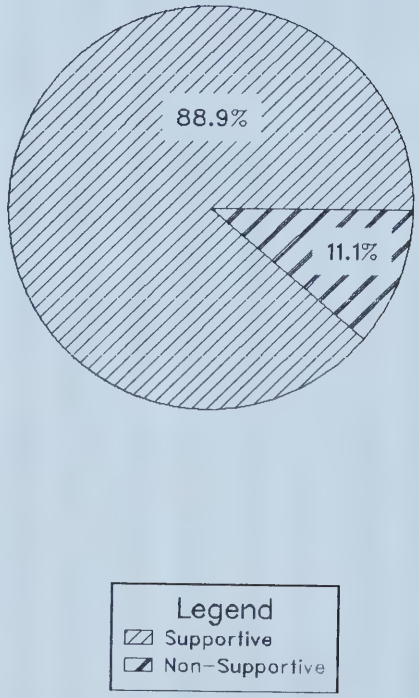

EVALUATION OF CATCH–AND–RELEASE:
PROGRAM PARTIPATION WILLINGNESS
TECHNIQUE USER EVALUATION
OF CATCH–AND–RELEASE:
PROGRAM PARTICIPATION WILLINGNESS
Percent
100
80
60
40
20
0
Mixed
Bait
Lure
Fly
Terminal Tackle Types
76.7%
23.3%
Legend
Willing
Unwilling

Figure 21

EVALUATION OF THE NORTH RAM RIVER
CATCH–AND–RELEASE EXPERIMENTAL PROGRAM





predominant proportion of bait anglers (54%) had a medium degree of support, although 26% were at the low support level. Of all the trout-oriented and non-troutoriented anglers, the mixed technique users were the least supportive (low support - 38%), with bait anglers close behind with 26%. It was interesting to see that the trout-orientation of anglers really did not appear to affect their degree of support for the catch-and-release program to any great degree. At the high level of support for catch-and-release, non-trout-oriented anglers response to the program was only slightly less than the mixed technique users and almost twice as much as trout-oriented bait anglers. Therefore it appears as though the really important variable for distinguishing amongst anglers regarding their support for the catch-and-release program is their use of terminal tackle. Although there are evident associations examined earlier between anglers' trout orientation and other variables of interest to management, the combination of both this variable and the technique use of anglers does not yield significant results in this analysis.

Angler evaluation of the four characteristics of the catch-and-release innovation was measured to see if there was any variation in how different terminal tackle users perceived them. It was found that differences existed among the terminal tackle typologies with regard to their compatability with catch-and-release (Table 30) and their evaluation of its trial potential (Table 31).

This data summary points out that the catch-and-release ethic, as a behaviour, is only of a low compatability for trout-oriented mixed, bait and lure anglers. However for fly anglers, catch-and-release behaviour is more compatable as 55% were measured in the medium to high compatability range in comparison with mixed technique users (32%), lure anglers (23%) and bait anglers (13%). As far as angler evaluation of the trial potential of catch-and-release, fly anglers and lure anglers tended to find catch-and-release more easy to experiment with than did mixed technique users or bait anglers. However this was to be expected since the catch-and-release regulation does not prohibit the use of lures or flies.

Table 29. Catch-and-Release Support by Angler Trout Orientation and Technique Use.

Catch-and-Release Support	Trout Orientation and Technique Use					
	Trout-Oriented Anglers				Non-Trout-Oriented Anglers	
	Mixed	Bait	Lure	Fly	Total (%)	
Low (0-3)	38	26	18	15	21	24
Medium (4-6)	21	54	23	29	39	34
High (7-10)	41	20	59	56	40	42
Total (n)	56	39	17	55	99	266

Chi-square = 23.8; d.f. = 8; $p < 0.01$.

Table 30. Catch-and-Release Compatability by Angler Terminal Tackle Use

	Angler Terminal Tackle Use (%)				
Catch-and-Release Compatability	Mixed	Bait	Lure	Fly	Total (%)
None	18	18	24	9	16
Low	50	69	53	36	50
Medium	25	8	23	40	26
High	7	5	0	15	8
Total (n)	56	39	17	55	167

Chi-square = 21.3; d.f. = 9; $p < 0.05$.

Table 31. Catch-and-Release Trial Potential by Angler Terminal Tackle Use

	Angler Terminal Tackle Use (%)				
Trial Potential	Mixed	Bait	Lure	Fly	Total (%)
None	36	23	12	14	23
Low	18	51	35	33	33
High	46	26	53	53	44
Total (n)	56	39	17	55	167

Chi-square = 18.8; d.f. = 6; $p < 0.01$.

While the data analysis did not show a difference in how all anglers evaluated the relative advantage or the complexity of the catch-and-release program the need still exists to provide and emphasize all aspects of the catch-and-release program's characteristics to trout anglers in the province. Understandably, angler compatability with catch-and-release behaviour may now be the weakest aspect, but other characteristics cannot be ignored. It may be surmised that there are certain associations in particular that help to describe the complex integration of characteristics in the social group of anglers surveyed in this study. An attempt was made to define, then measure and thus describe individual opinions, use patterns, level of intensity and experience, preferences, resource knowledge and socio-demographic characteristics. These are detailed in the following section.

Catch-and-Release Support: Pertinent Angler Attributes

As presented, there are several integral attributes common to sport fishermen who are more supportive toward this restrictive regulation and to those who have progressed to the complex in technique use. It was determined that trout anglers who were most receptive to, and accepting of, the catch-and-release innovation were more likely to be:

- Of an intermediate age group (25-45).
- Of a high socio-economic status level.
- Of a higher educational background.
- More qualitatively than quantitatively oriented with regard to their catch preference.
- More intense as far as days fished.
- More experienced as far as years fished.
- Very knowledgeable about the freshwater fishery resource in terms of identification skills.
- Heavily reliant upon mass media sources for fishing information and somewhat reliant upon word of mouth information sources.

Previously, it was determined that technique use was significantly associated with the socio-demographic variables of age, education and socio-economic status. As well, there were

similar associations noted with the years of angling experience, degree of fishery resource knowledge and whether there was any previous experience with catch-and-release trout management programs elsewhere. Tendencies of association also existed as far as the fishing intensity of anglers and their sources of general fishing information, as well as their preferred fish catch. However, there were associations revealed between other variables and trout-oriented technique users which did not occur with anglers who were very supportive. This may delineate the presence of a subtle difference between innovators, early adopters and opinion leaders with regard to the catch-and-release program here in Alberta.

Socio-demographics

It was determined that angler acceptance of the catch-and-release trout management program is significantly associated with age, education and socio-economic status demographic descriptors. Each relationship was first confirmed using the chi-square test and then further examined with the one-way analysis of variance at a 0.05 confidence level of statistical significance.

Anglers who were in the intermediate range of age categories (26-35 years and 36 to 45 years) differed significantly from the youngest age category regarding their degree of catch-and-release acceptance. While the former angler categories were relatively close in their mean acceptance scores (6.17 and 6.15 respectively), both were quite different from the mean acceptance score of the youngest age category (16-25 years) which was measured at 4.86.[1]

While the oldest and youngest age categories of anglers differed significantly from the other categories, they did score relatively evenly in their degree of innovation acceptance across all the support levels as can be seen in Table 32.

Anglers with a high acceptance of the catch-and-release program were likely to have an intermediate to a high degree of formal education, indicating to a limited extent that a

[1]For all such relationships, innovativeness was measured on a ten (10) point scale when doing simple one-way ANOVA's. Zero (0) indicating low acceptance and ten (10) indicating high acceptance.

Table 32. Catch-and-Release Acceptance by Angler Age

Receptivity Toward Catch-and-Release	Angler Age				
	16 to 25	26 to 35	36 to 45	Over 45	Total (%)
Low Support	36	17	12	33	24
Medium Support	32	32	45	26	34
High Support	32	51	43	41	42
Total (n)	59	75	67	64	265

Chi-square = 17.1; d.f. = 6; $p < 0.01$.

positive association exists. While 72% of the anglers without a high school education were of a low or medium level of catch-and-release acceptance, 85% of university educated anglers were of a medium or high level of catch-and-release acceptance although little difference existed between anglers of an intermediate and a high education level as both had approximately 49% with a high level of catch-and-release support (see Table 33). The one-way analysis of variance revealed that there was indeed a significant difference in the level of catch-and-release support among the differently educated angler categories. While anglers of less than a high school education had a mean acceptance score of 4.76, those anglers with higher education levels scored 5.85 (high school plus) and 6.30 (university).

The third socio-demographic characteristic which was found to be related to an angler's catch-and-release program acceptance was the socio-economic status of anglers. Those anglers of a low socio-economic status differed significantly in their degree of catch-and-release acceptance from those anglers who were classed in the two higher socio-economic status levels. Whereas low status anglers were relatively even in their acceptance of catch-and-release, middle and upper status anglers were definitely more supportive as they each had approximately 87% with medium and high catch-and-release support. The ANOVA statistic revealed a significant difference between mean catch-and-release acceptance scores with middle and high status level anglers scoring 6.13 and 6.35 scores respectively, while low status anglers only registering a mean acceptance level of 5.00. Thus, it would appear that to a limited extent a positive relationship existed between an individual angler's socio-economic status and his degree of acceptance of the catch-and-release trout management program (see Table 34).

Catch preference, fishing intensity (days per year) and experience (years of fishing) and general fishing information sources were all significantly associated with the degree of innovation acceptance held by anglers. See Tables 35 and 36.

Anglers who were the most intensive in their fishing behaviour (highest number of yearly fishing days) had the highest percentage (34%) of individuals with a low degree of

Table 33. Catch-and-Release Acceptance by Angler Educational Attainment

Receptivity Toward Catch-and-Release	Angler Educational Attainment			
	Under High School	High School Plus	University	Total (%)
Low Support	30	23	15	24
Medium Support	42	29	35	34
High Support	28	48	50	42
Total (n)	76	149	40	265

Chi-square = 10.5; d.f. = 4; $p < 0.05$.

Table 34. Catch-and-Release Acceptance by Angler Socio-economic Status.

Receptivity Toward Catch-and-Release	Angler Socio-economic Status			
	Low	Intermediate	High	Total (%)
Low Support	34	12	14	24
Medium Support	30	42	36	34
High Support	36	46	50	42
Total (n)	137	67	62	266

Chi-square = 15.9; d.f. = 4; $p < 0.01$.

Table 35. Catch-and-Release Acceptance by Angler Intensity.

Receptivity Toward Catch-and-Release	Angler Intensity (Days Fished/Year)				
	Under 10	10-19	20-30	Over 30	Total (%)
Low Support	18	26	18	34	24
Medium Support	48	31	32	19	34
High Support	34	43	50	47	42
Total (n)	74	72	40	64	250

Chi-square = 16.6; d.f. = 6; $p < 0.05$.

Table 36. Catch-and-Release Acceptance by Angler Experience.

Receptivity Toward Catch-and Release	Anglers' Years of Fishing Experience (%)				
	Under 10	10-19	20-29	Over 29	Total (%)
Low Support	32	19	17	29	24
Medium Support	43	36	28	24	34
High Support	25	45	55	47	42
Total (n)	75	93	60	38	266

Chi-square = 15.9; d.f. = 6; $p < 0.05$.

catch-and-release acceptance. However, it is important to recognize that these active anglers also had the second greatest percentage (47%) of anglers in favour of the catch-and-release innovation. It was also evident that anglers with under 10 fishing days and those with between 20 and 30 fishing days were much more supportive in general of the catch-and-release program than any other anglers.

With regard to the relationship of how anglers accepted the catch-and-release innovation and their years of fishing experience, it was found that acceptance of the catch-and-release innovation was highest among anglers having between 20 and 29 years experience. As well, those anglers with 10 to 19 years of experience were also quite supportive in that they had 81% with medium and high catch-and-release support compared to 83% for those anglers with between 20 and 29 years of fishing experience. It appeared that the least experienced and the most experienced anglers had the highest proportions of anglers with the lowest level of catch-and-release acceptance.

Although a strong association was not indicated, it would seem that as anglers relied more and more on both other anglers and mass media sources and to some extent upon self-discovery methods, for their general information about fishing, they increased in their degree of catch-and-release acceptance (see Table 37).

Angler acceptance of the catch-and-release innovation was found to be dependent upon their previous experiences with catch-and-release trout management programs, their degree of knowledge about the freshwater trout fishery, their preference of sport fishery management strategies for depleted fisheries and their preferred fish catch. Tables 38 and 39 describe the results determined by the data analysis.

Angler orientation toward their fish catch showed higher support of the catch-and-release program by those who preferred to catch a couple of large fish (60%), whereas the predominant majority of anglers who preferred to catch many small fish had low catch-and-release support (52%). This shows that catch-and-release may derive greater support from anglers desiring the qualitative aspects of the catch. Highly knowledgeable

Table 37. Catch-and-Release Acceptance by Angler Sources of General Fishing Information.

Receptivity Toward Catch-and-Release	Angler Sources of General Fishing Information				
	Government Staff	Mass Media	Word of Mouth	Self-discovery	Total (%)
Low Support	13	14	28	22	24
Medium Support	61	32	28	42	34
High Support	26	54	44	36	42
Total (n)	23	35	158	50	266

Chi-square = 14.0; d.f. = 6; $p < 0.05$.

Table 38. Catch-and-Release Acceptance by Angler Catch Preference.

Receptivity Toward Catch-and-Release	Angler Fish Preference			
	Many Small	Several Medium	Couple Large	Total (%)
Low Support	52	23	16	24
Medium Support	26	39	24	34
High Support	22	38	60	42
Total (n)	23	174	67	264

Chi-square = 21.0; d.f. 4; $p < 0.001$.

Table 39. Catch-and-Release Acceptance by Angler Resource Knowledge.

Receptivity Toward Catch-and-Release	Anglers' Resource Identification Knowledge		
	Low	High	Total (%)
Low support	28	8	23
Medium support	36	29	34
High support	36	63	43
Total (n)	206	59	265

Chi-square = 15.6; d.f. = 2; $p < 0.001$.

anglers led those anglers with a low level of knowledge by over 25% as far as their level of catch-and-release support was concerned. While the distribution of support for catch-and-release was relatively even among anglers of a low resource knowledge level, over 90% of those anglers of a high knowledge level were at least moderately or highly supportive of the catch-and-release program as can be seen in the accompanying table.

Previously experienced catch-and-release anglers were more likely to be at least moderately receptive to the application of catch-and-release. Anglers without any previous experience were very supportive of catch-and-release, with 74% having a medium to high acceptance level. However, comparatively speaking, 72% of experienced catch-and-release anglers versus 40% of inexperienced anglers had high levels of catch-and-release acceptance levels (see Table 40).

Table 40. Catch-and-Release Acceptance by Angler Previous Catch-and-Release Experience.

Receptivity Toward Catch-and-Release	Angler Previous Catch-and-Release Experience (%)		
	Inexperienced	Experienced	Total (%)
Low support	26	0	23
Medium support	34	28	34
High support	40	72	43
Total (n)	227	29	256

Chi-square = 14.2; d.f. = 2; $p < 0.001$.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Preamble

The primary objective of this work has been to document and analyse the support of anglers in Alberta for a catch-and-release trout management program. The researcher also undertook to clarify and develop the theoretical premise of catch-and-release fisheries management and the associated biological and social science variables that embrace it. Therefore the following material will address both the conclusions derived from the literature review and from the study before ending with the recommendations of the study.

Conclusions of the Literature Review

The literature review in this interdisciplinary study showed future promise for both the maintenance of improved trout population dynamics and the delivery of a quality range of trout recreational experience opportunities for the trout angler. Although the main social science theory discussed within this study's approach has been extensively delineated by a range of researchers, it has not as yet been widely integrated by wildlife agencies within the human dimensions of wildlife management objectives. The opportunity exists for Alberta to serve as a leader in the integration of these principles within an applied management context.

With the advent, expansion and success of catch-and-release, no kill trout management programs elsewhere in Canada and in the United States, precedents and observed public acceptance are already in place. In many northern fishing lodges, long concerned with slow growing trout vulnerable to over-depletion, artificial replicas of trophy fish caught under "no kill" regulations are the only method an angler has of displaying a physical trophy of the fishing trip. Many such lodges now incorporate into their magazine advertisements the catch-and-release symbol, which to many discriminating anglers is rapidly becoming synonymous with a quality angling experience. It is in the best interest of Albertans and their sport fisheries for Alberta Fish and Wildlife to follow British Columbia's lead in Canada to incorporate catch-and-release management strategies into an expanded range of applications.

The North Ram River catch-and-release no kill trout management program may provide the Alberta Fish and Wildlife Division with an inexpensive method of protecting and maintaining a population of wild, self-regenerating cutthroat trout, although until biological results confirm this, little can be assured. However, if results are similar to those in Idaho, the continuation of the catch-and-release approach may be warranted. Angler satisfactions may include more than just aspects of the catch, since the social carrying is also altered and has proved to be an important management consideration elsewhere. Biological results, as summarized in this study, have shown that under a catch-and-release management program the relative proportion of large cutthroat trout available for sport fishing increases, thereby usually permitting higher catch rates of larger trout. While care is normally taken to avoid the stunting of populations due to an over-abundance of fish, this may not overly impact the experiences of trout fishermen, and in fact the presence of many small fish in certain streams of family fish-for-fun stretches under catch-and-release management is often a preferred management outcome.

Other conclusions that were made from this biological literature review stressed that some fish species will adapt more readily to catch-and-release management than will other species in that their ability to recoup from the metabolic fatigue of exercise from being played by anglers is much greater. As well, there is less delayed mortality and a faster recovery rate for wild trout species versus stocked species. A general requirement for the improved biological management of fisheries is to ensure that any environmental factors negatively affecting fish are kept to a minimum wherever and whenever possible in order to reduce future sources of mortality.

There is a potential in Alberta for the successful application of a variety of catch-and-release strategies. Streams can be managed on a sectional zoning basis (i.e. a stretch between this bridge and that bridge is catch-and-release, other portions under ordinary regulations); and with slot-release strategies (release of individuals under 9" and over 20"); with certain species to be released and others kept according with regulations; full stream

designations (e.g. the North Ram River); and with multiple applications (e.g. one stretch fly-fishing only - no kill; the next section - no kill (fly or lure), the next with slot-release regulations, and another with set creel limits). Such complex regulations are becoming the rule rather than the exception in many jurisdictions, and the results are highly positive biologically and widely accepted by the angling public.

The literature review also revealed that agencies considering the introduction of catch-and-release regulations need to better understand and predict the relationship between user receptivity toward, and acceptance of, such innovative practices. To this end, it is important to recognize that there is an already rich source of information on understanding how a social system goes about becoming aware of, taking an interest in, evaluating, trying and then either adopting or rejecting the proposed new idea, technique or practice. The literature review attempted to summarize a part of this process in the context of catch-and-release.

Study Conclusions

To reduce the current heavy reliance upon enforcement methods that generally accompanies special regulations, agencies should couch regulatory information within a broader context of environmental education, and communicate not only through its publications and personnel, but also through open forums and expanded sources of media influence. Agencies should undertake the establishment of expanded regional dialogue opportunities through extension programs designed to interact and better communicate with community organizations and land owner groups. Agencies need to become more diffused in their approach to managing wildlife resources through the recognition that there are non-consumptive attributes to wildlife recreational pursuits which in the past have been predominantly harvest oriented. Catch-and-release regulations are consistent with meeting the needs of users who do not seek to maximize their harvest, but rather seek the intangible satisfactions of accessing the province's freshwater resources for non-consumptive purposes.

There may appear to be concept support for the provision of catch-and-release trout management programs in the province of Alberta, but there also appears to be a large gap between such support and current angler behaviour (Figure 17). While much in the way of establishing and maintaining improved communication channels needs to be done, there is a core of individual anglers and interest groups who can be enlisted to assist the agency in promoting a new angler conservation ethic, if the agency approaches them in the appropriate manner required to foster a mutual, cooperative atmosphere of trust and respect.

Of interest to future research intending to build upon this study are Bryan's (1979) inferences about the progressive development of trout anglers along a continuum of recreational specialization (Figure 3). Although the comparability of the elements within angler orientation components is not identical between this study and Bryan's (1979) theoretical framework, there need not be such a comparison in order to derive useful applications from the results. While technique and technique-setting specialists are defined as fly fishermen by Bryan (1979), and two other categories describe the balance of trout anglers in his work (occasionalists and generalists), tnis study has defined biologically relevant conceptual categories in order to provide a readily discernable distinction among terminal tackle types (non-specialists, bait anglers, lure anglers and fly anglers) for management utility.

The expansion of the catch-and-release trout management program in Alberta will further benefit anglers by its tendency to focus compatable anglers in similar places, decreasing the potential for asymmetrical antipathy among trout anglers, and thereby increasing the overall opportunity for achieving a quality recreational angling experience. This reaffirms the conclusions of Harry et al. (1972) and Schweibert (1978). Conflicts between dissimilar angler sub-typologies is known to diminish the recreational experience, while conversely, positive interactions with other anglers of similar philosophy and experience expectation will prove to enhance the angling experience. Based upon the results of this study, bait anglers and non-specialists could probably enjoy the same resource at the same time

without major conflicts. Fly fishermen and lure anglers could probably share the same fishery with each other; however, there are also data which warrant the designation of separate "fly fishing only" sections since the literature review has shown how receptive fly fishermen are toward a biologically sound program (Manfredo and Anderson 1982). Therefore the catch-and-release program, if applied through stream designation and stream zoning, will play an important role in facilitating preferred angler contacts.

This research further attempts to provide an exploratory understanding of how the adoption-diffusion of innovations interrelates with the catch-and-release trout management program. The study did not attempt to provide a definitive statement on the specific characteristics comprising the sub-typology profiles of anglers and their direct applicability in understanding the trout fishermen social system and its relevance to the acceptance of a restrictive fisheries management regulation. Rather, much as Bryan (1979) stated with his specialization continuum theory, this study addressed the relevance of applying this specific principle to biological systems management (Figure 3). Further research should be done on the application of this theoretical framework, since agencies will not be able to avoid an increase in the complexity of wildlife management systems. This increased complexity may be attributed to trends which suggest shrinking habitats, projected increases in the number of sport fishing participants, an increased sophistication of the angling public and of course the constant presence of uninformed or misinformed resource users. Such angler typologies have relevance for two distinct reasons.

1. To gauge the potential biological impact of different tackle types on trout species and/or populations.

2. To provide a predictive management tool to assess angler reaction in advance to proposed regulation changes from the visible cue of angling equipment choice.

As a result, marketing strategies may be devised more accurately utilizing these predictive profiles prior to potential changes in regulation (general and/or site-specific).

The data revealed in this study lend strong support to the Alberta Fish and Wildlife Division to continue their positive initiatives displayed in the North Ram River experiment. Participating in catch-and-release fishing is an untried behaviour for the majority of anglers interviewed (89%). Even so, as a viable management tool and as an opportunity to maintain recreational angling, it is seen as a worthy concept by an overwhelming majority of these sport fishermen (93%). It was highly encouraging to see that in spite of the limited prior experience, 41% of the sample said they would be attracted to catch-and-release fisheries, citing various perceived benefits (e.g. less crowding Canadian national parks are properly criticized for not yet emulating the lead of the U.S. National Park Service, where the sport fishery management policy often incorporates catch-and-release programs. and the increased likelihood of being able to catch trout).

Anglers were quite supportive of Alberta Fish and Wildlife's decision to apply a catch-and-release regulation on the North Ram River (63%), but to a limited extent even supported the permanent management of this cutthroat fishery under such a regulation (28%). Anglers who primarily fish for trout (trout-oriented anglers in the data sample) advocated that the Alberta Fish and Wildlife Division continue to assess the biological status of trout fisheries in the eastern slopes and where deemed appropriate, implement an expanded system of catch-and-release sport fisheries (70%).

Considering those anglers holding the minority view, 20% of all anglers interviewed stated that they were not willing to even try fishing on a catch-and-release fishery, and 7% indicated that they thought the program concept was not worthwhile at all. Instead, they advocate many other solutions, some worthwhile (e.g. habitat improvement) and some costly (e.g. intensive stocking programs). Thus, there are trout anglers who feel that while the program may be worthwhile, they personally would not be willing to participate in it. Of those anglers who had previously experienced catch-and-release fishing elsewhere, 67% indicated that they preferred catch-and-release strategies be implemented in Alberta for depleted trout fisheries over any other management technique (e.g. stream closure, etc.).

Support for catch-and-release regulations should expand with additional exposure, considering current societal trends toward more nonconsumptive uses of our wildlife.

Specifically, eight per cent of anglers interviewed disagreed with the North Ram River experimental catch-and-release program for cutthroat trout. Over half of the trout-oriented anglers (53%) thought that the North Ram River should not be permanently managed as a catch-and-release fishery. A total of 50% indicated that they were not attracted to fish at a catch-and-release fishery, and only 10 per cent were not in favour of expanding the catch-and-release trout management program to other locations in Alberta.

A degree of angler displacement through the institution of a catch-and-release trout management program is unavoidable. Due to the timing of this study, it was impossible to clearly ascertain who, and how many, anglers may have been displaced from the North Ram River. During the interview anglers were asked whether they had fished the North Ram River prior to the program as well as whether the catch-and-release program dissuaded them from angling there. Only 6.3% of the angling sample specifically stated that they were displaced from fishing on the North Ram River because of the catch-and-release program's presence. If the rationale and benefits of catch-and-release management programs were to be actively promoted by the agency and steps were taken to demonstrate the benefits of participation (e.g. higher catch per hour ratios, and access to fisheries not otherwise available), this percentage of non-compliers would predictably be greatly reduced. The catch-and-release program's viability may be dependent upon whether anglers have access to and become aware of an expanded spectrum of experiential opportunities from which to select and thus optimize their individualized definitions of quality trout fishing.

As revealed in this study, previous experience is an important factor in an individual's acceptance of catch-and-release. The trial potential and compatability measures elicited and quantified from the anglers in this study about the catch-and-release program would probably increase in utility value if the proposed expansion of this program's application proceeds. Other attributes of the program (relative advantage and complexity) should be positively

perceived by the sport fishing social system if the Alberta Fish and Wildlife Division increases and improves its communication linkages and public education efforts.

There is abundant evidence of the complexity of the sport fishing social system provided in this study. Apart from the catch-and-release focus of this investigation, the data assembled also represented an important initial attempt to describe angler profiles in Alberta. This exploratory study has therefore assembled and analysed data about angler socio-demographics (age, education and socio-economic status); committment (experience and fishing intensity); angler knowledge and familiarity with the fishery resource, angler preferences (trout orientation, angling technique, fish catch and management strategies); plus other meaningful and useful information on anglers in Alberta.

In this base line data set, the study revealed that the majority of anglers were found to be between 25 and 45 years of age (mean = 35), similar to the average age of the Albertan angling population in 1980, which saw the concentration of anglers between 25 and 34 as 30% and between 35 and 44 as 22% (Longmore, Brickley and Stenton 1982). The anglers in this sample were generally well educated, the majority of individuals having attained at least a high school diploma and 15% of the sample having attained a university education. Such a large proportion of highly educated individuals is not surprising, since an article in the Edmonton Journal (March 27, 1986), cited that Calgary and Edmonton residents were two of the three most highly educated city populations in Canada. Of all the major Canadian cities, Calgary residents had the highest proportion of individuals (over 14 years of age) with a post-secondary education at 49.5%, whereas Edmonton has the third highest with 45.3%.

Angler terminal tackle use played a key role in this study's development of profiles. Although angler orientation toward trout was not critical to this study's conclusions, it was found that 63% of anglers interviewed spent over 50% of their effort fishing for trout. This result is again readily comparable with the 1980 angler preference for trout (all species), where trout led the popularity list for Alberta sportfish species for both resident and non-resident anglers (Longmore, Brickley and Stenton 1982). With respect to the varying use

and preference of techniques, anglers interviewed had a significant proportion who were not specialists at all - approximately one-third of anglers used at least a combination of two techniques. This trout-oriented angling sample was composed of 34% non-specialists, 23% bait anglers, 10% lure anglers, and 33% fly anglers. The data is revealing since misconceptions seem to abound regarding angler stereotypes. Researchers have found technique specialist categories (bait, lure, fly), to be useful. For example, Manfredo and Anderson (1982) found that among stream anglers, lure specialists spent less time than did other technique users in pursuit of trout. This concurs with data reported here. Johnson and Bjornn (1978) also refer to the technique or equipment variable as a determinant of angling expertise, which lends credibility to the definition of angler types based upon their progressive level of technique specialization, and the preliminary angling typology predictors previously discussed.

Two other major components of angling participatory patterns are the years of fishing experience (mean = 20) and the intensity with which angling is approached (mean = 25 days fished). Specifically, this study found that the number of days spent fishing was statistically significant in relation to terminal tackle typologies. Other researchers (Hooton 1982; Hunt 1981; Manning 1979), also found that fishing intensity was a critical descriptor of angling populations. In this study, it was found that fly fishermen were very serious about their angling, since 43% of these specialists fished over 30 days the previous year. Bait anglers were not far behind at 38%, and non-specialists had 30% of their anglers all fishing more than 30 days the previous year. Fly anglers tended to rely more on self-discovery methods of gathering information and appeared to value having the opportunity to fish over losing access to a fishery. This study's results with regard to an angler's years of fishing experience reflected the previous findings of authors (Schoolmaster and Frazier 1985; Van Kirk 1984; Hooton 1982), verifying the importance of gathering experience data. In particular, among all of the anglers interviewed, while those with the least years experience (under 10 years) did have almost one-third who fished more than 30 days, thereafter there was an increase in angling intensity culminating in 43% of those anglers with at least 30 years of experience

fishing a minimum of 31 days in a year.

It was found that as anglers' years of experience increase: 1) their general time commitment to fishing increases; 2) their preference of fish creel shifts from numbers to size; 3) their reliance upon word of mouth sources decreases while information self-discovery methods increase; 4) they have a more open approach to releasing fish; 5) they gradually go from having very little or almost no knowledge about the fishing resource to a higher knowledge level; 6) their perception of a quality angling experience shifts from consumptive to non-consumptive. This gives support to Bryan's (1979) recreational specialization continuum and also lends credence to the relationship between this and the angler characteristics attributed to opinion leaders, innovators and early adopters of the catch-and-release program.

The data suggest that while fly anglers support innovative sport fishery management programs and are probably innovators and early adopters or opinion leaders, some non-specialists and ocassionally a few lure anglers as well as non-trout-oriented anglers also agree that the maintenance of wild and wisely allocated trout fishery resources is of utmost concern.

The other variables considered within the context of this study were angler preference of fish catch and the sources of general fishing information consulted. While there were other data gathered, these two variables in particular were found to have the greatest management implications. It was found that the majority of anglers when asked to choose between three alternatives of catch, preferred the option of catching several medium fish. In particular, younger, less experienced (10-19 years) anglers (who tended to be either bait or non-specialists) preferred catching many small fish (mean = 60%), whereas older, more experienced (more than 20 years) anglers were divided somewhat as to their preferred catch between several medium fish (mean = 71%) and a couple of large fish (mean = 24%). Lure anglers and some non-specialists tended to prefer a catch of a couple of large fish, while fly anglers and the balance of non-specialists opted for catching several medium fish. These

results are supported to a certain degree by prior research results (e.g. Ball 1971) and emphasize that quality fishing experiences are indeed perceived differently by different segments of the angling public. It appears that a compromise between size and number of fish caught has to be made by sport fishermen and this augurs well for trout populations which are being rebuilt since the larger individuals tend to be the spawners necessary for re-establishing healthy population dynamics. It may be that in the future many trout streams will be managed to encourage the harvesting of fish under a certain size/length while still protecting the broodstock.

One of the most relevant variables for management use is the source of general fishing information which anglers consulted. While statistically there was no real major linkage found involving this variable, there are many crucial aspects that need to be clarified to improve the management agency's approach to communication with anglers. To underscore the importance of understanding the anglers' social system, the study results confirm that word of mouth information sources are the predominant channels of communication (59%). Self-discovery methods were surprisingly high at 18%, which indicates that many anglers chose to rely upon their own initiatives when seeking general fishing information. These tendencies suggest that although anglers consult the Alberta Fish and Wildlife regulations for regulatory information almost all the time, they do not consider the agency as a major source of information about anything except for enforcement regulations.

Impacts from multiple resource management in the Rocky Mountain's eastern slopes, as well as the increasing numbers of anglers seeking trout fishing experiences, place an unprecedented stress on the trout fisheries in the province. This study's results confirm that the majority of anglers are receptive to the need for more intensive management practices and strategies.

When anglers were asked what management strategy they preferred to see implemented for depleted trout fisheries, the most common options mentioned were fishing closures, imposition of limits (size/numbers of allowable fish creel and/or length of season),

stocking practices or some form of a catch-and-release program. The researcher recalls one angler in particular who in fact advocated a combination of all these strategies in order to arrest what he defined as "an evident decline in the quality of trout fishing in the foothills". He was also deeply concerned with the status of wild versus stocked trout. Lure anglers appeared to favour stocking fisheries (52%) much more than either bait anglers or non-specialists (mean=36%) and quite a bit more than fly fishermen (18%). The data suggest a definite demand exists for put-and-take fisheries, but as well, there appears to be a need for a variety of native, natural spawning settings to satisfy the complete range of angler aesthetic preferences and desired social conditions.

Another definitive variable of sport fishermen's management orientation was the degree of fishery resource knowledge held by those interviewed. It was surprising how poorly anglers in general knew the common sport fish, especially since the illustrations were cut out of an Alberta Fish and Wildlife brochure describing the sport fish in the province. If fishing licences required a basic examination in the manner that driving licences are administered, the majority of anglers would be unsuccessful in acquiring a licence. To many fishermen, knowledge of the resource makes little difference in the satisfactions and benefits they receive. However this evident lack of knowledge depicts what could become a major barrier to the future success of sport fishery management endeavours. If an angler is not knowledgeable about the factors that combine to create an optimal fishery, then he will probably ignore or even abuse the very aspect that makes the crucial difference to the continued well-being of the fish and/or habitat which comprise that fishery. This severe lack of knowledge points out the strong need to encourage all sport fishermen to learn more about fish and the ecology of the fishery resource, and also predicts that catch-and-release regulations requiring the release of a particular species (e.g. bull trout, *Salvelinus confluentus* (Suckley)) would largely fail without special efforts at angler education.

Recommendations of the Study

It is recommended that appropriate and ecologically sound angling behaviour should be stressed by Alberta Fish and Wildlife in an effort to further develop in anglers an improved conservation ethic. More anglers should also come to realize that there is a proper technique to releasing fish, so that mortality in the future may not be as impacted by improper and damaging release techniques practiced by uninformed and/or misinformed anglers.

Anglers experimenting with the catch-and-release program on the North Ram River may not be overly impressed with their experience due to conceivably low numbers or small size of trout present. To encourage the adoption of this program by more anglers, it is recommended that the catch-and-release program should be introduced to an additional trout fishery with a less serious stock depletion. This would ensure faster biological results for management assessment and also yield quicker benefits for trout fishermen, thus avoiding an unnecessary and possibly damaging time lag between initiation and satisfactions derived. As well, for a wider exposure to sport fishermen in the province, it is recommended that another catch-and-release fishery be located closer to a major populated community if at all possible. The Parks and Recreation Department of the City of Edmonton sponsored a summer public program in the summer of 1986 on catch-and-release fishing which bodes well for wider public dissemination of the release ethic especially among novice anglers. As well, a portion of the Bow River (which passes through Calgary, Alberta) has a size regulation policy and is an excellent example of how anglers positively react to a restrictive management program when the observability of satisfactory results is high, and the opportunity is easily accessible. However, even assuming optimal biological and sociological conditions are present, it often takes a long time for an individual to go from awareness of an innovation through the interest, evaluation and trial stages to adoption. This time factor ranges from five to ten years and possibly more, depending upon the individual and his social system. Here an important aspect for potential adopters, and for anglers seeking to reinforce their adoption decision, is

the provision of information regarding the success of similar programs elsewhere.

Regulation enforcement will play an important role for the first several years on the North Ram River especially because of its accessibility. Cooperative endeavours between Alberta Forest Service guardians and Alberta Fish and Wildlife officers are commendable and should be continued. Over time, however, less reliance on government field staff should occur as anglers fishing for fun will serve as their own enforcers when the fishery becomes valued as a quality sport fishing opportunity. Nothing is quite as effective as peer approval, especially among anglers who are ethical and knowledgeable about their sport and committed to a catch-and-release application.

The data revealed that there may be a larger proportion of anglers in the province using flies for even a portion of their fishing than was perceived previously. This study found that the mean average use of fly tackle was 32% compared to that of natural bait use (37%) and the use of lures (mean = 31%). Fly fishing no longer seems to be the domain of only the few, but seems to appeal to many anglers in Alberta. In locations such as Yellowstone National Park, "Fly-fishing Only" sections have become synonomous with catch-and-release for the purpose of reducing hooking mortality and these designations of separate sections have proven to be highly popular with anglers. Such an attitudinal shift in Alberta may not happen at all, but there seems to be more enthusiasm today for fly fishing, so such a situation may be feasible in the future. The study concluded that angler support exists for the expansion of a mandatory catch-and-release program and this researcher recommends that it may be especially appropriate for such threatened trout species as the bull trout.

It is recommended that the Alberta Fish and Wildlife Division should encourage further study of the social system of sport fishermen in order to better identify and take advantage of the current knowledge available on how social systems will consider and possibly adopt an innovation. In this exploratory study of anglers in Alberta, it has been effectively demonstrated that this is a potentially relevant way of predicting how trout anglers will respond to catch-and-release trout management programs.

Results reported here have indeed reaffirmed that terminal tackle usage by anglers defines fly fishermen as the probable innovators and the predominant majority of early adopters. It is apparent that trout-oriented fly specialists are the most receptive portion of anglers to catch-and-release. They closely match the characteristics of innovators and early adopters described by Rogers and Shoemaker (1971), as being individuals differing little in age; having a higher degree of education, knowledge, socio-economic status; having complex needs and complex participation; having a better attitude towards change; being more informed about the catch-and-release innovation; being more socially active in interest groups and probably being more cosmopolitan in nature.

For a more accurate measurement of angler acceptance of the catch-and-release program in the future, how angler responses were measured for each characteristic of this innovative program could be better designed. The individual characteristics of relative advantage, compatability, complexity, trial potential and observability should be evaluated individually and weighted according to professional criteria set by both biologists and sociologists. A method for implementing such a value system of attributes has been designed previously for environmental impact assessments and is called multiattribute utility technology.

Considerable further research is recommended concerning such predictive profile assessments before a wider application of such data is attempted. These profiles are continually evolving and should be periodically re-examined and updated in further longitudinal research efforts (e.g. data collected at time one and time two) to reflect how sport angler use fluctuates with changing regulations and improved public promotion and education.

The compilation of angler use patterns and experiential descriptors (preferences, expectations, resource familiarity, satisfaction, etc.) is recommended on a regular basis and could be accomplished in part with a user survey done in conjunction with licence issuance on an interval basis (e.g. every 3 to 5 years). It would be worthwhile to measure both cognitive

and attitudinal shifts in anglers in order to determine if communication strategies have been effective. To efficiently communicate to all types of anglers, such data should also identify all of the various communication channels used by those angler types as well as individuals within each user type who act as opinion leaders. Potential opinion leaders should not only be recruited in organized fish and/or wildlife groups but in regional and community organizations as well, since all types of social interaction systems are integrated with one another. The data reaffirmed that only 15% of anglers appear to hold fish and/or wildlife memberships, therefore the continued reliance on fish and/or wildlife organizations alone as a source to communicate to the angling public is not adequate at all.

The study also reaffirmed that agencies wishing to increase the range of experiential opportunities to its client systems must actively endorse and manage for separate user systems. Therefore it is recommended that the Alberta Fish and Wildlife Division should strive towards adopting the recreation opportunity spectrum now being used elsewhere in order to provide an improved range of angling experiences for different anglers using the various types of terminal tackles. Catch-and-release regulations serve as a positive step in the adoption of this opportunity spectrum. This management objective might best be met through direct distribution and/or mailout of regionally based 'sport fishing experience selectors' (Krumpe and Brown 1982), which is basically a decision matrix of the spectrum of recreational angling opportunities available to anglers. Further to this, it is recommended that the Fish and Wildlife Division shift more purposefully into the adoption of more complex regulations, using simple modes of communication concerning special regulations. The utility of zoning fisheries throughout the province according to their required biological management needs and their role in the recreation opportunity spectrum is endorsed and also recommended. This will aid in the improvement of communications with anglers within each management region and will also aid in reducing unnecessary conflict among different angler types, thus increasing the perceived quality of angling opportunities among all sport fishermen.

The study concludes that a catch-and-release management program applied to the North Ram River trout fishery is biologically feasible and sociologically sound, and that its adoption would probably be supported by the majority of Alberta trout anglers. Vocal minority response to the contrary is predictable from a defined segment of the angling spectrum just as the most vocal support derives from another predictable segment of the spectrum. The degree of existing support is in many ways remarkable considering the general lack of experience Alberta anglers have had with such regulations. The concept of catch-and-release special regulations is supported by a number of successful precedents elsewhere, and the current caution against wider applications in Alberta in both geographical area and by regulation type (e.g. stream zoning, slot limits, etc.) is unfounded in all but the cautions which are associated with the political arena. The results reaffirm the wisdom of the experimental North Ram River catch-and-release regulation, encourage its expansion elsewhere in Alberta and provide a reasonably valid, statistically sound, accurate assessment of trout angler response to the program.

IX. PHOTOGRAPHIC PLATES

Plate 1. Interviews were administered to anglers along Shunda Creek, not far from Nordegg, Alberta. Here the researcher talks with one of the survey subjects.

Plate 2. The presence of uniformed agency personnel on site, even if random, is usually enough of a deterrent to ensure angler compliance with regulations.

Plate 3. Anglers were interviewed at their camp as well as while fishing. Here the research assistant, Mr. Robert Purdy, talks with anglers about their experiences, attitudes, etc.

Plate 4. A broad range of anglers as well as other recreationists use the Alberta Forest Service campgrounds. Here, Harlech Recreation Area packs them in for the coming night.

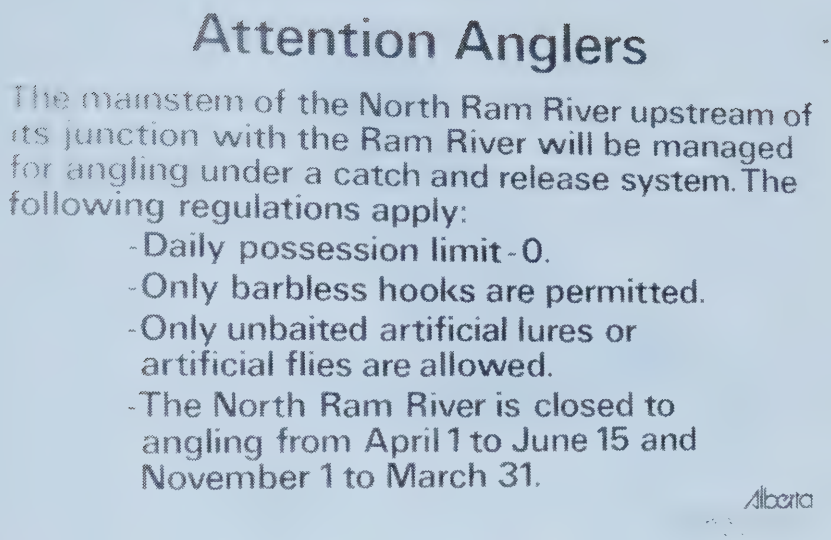

Attention Anglers
The mainstem of the North Ram River upstream of its junction with the Ram River will be managed for angling under a catch and release system. The following regulations apply:
- Daily possession limit - 0.
- Only barbless hooks are permitted.
- Only unbaited artificial lures or artificial flies are allowed.
- The North Ram River is closed to angling from April 1 to June 15 and November 1 to March 31.
Alberta

Plate 5. On site information using non-personal channels of communication are mandatory for innovative management programs, although such channels should only be part of the total agency communications approach.

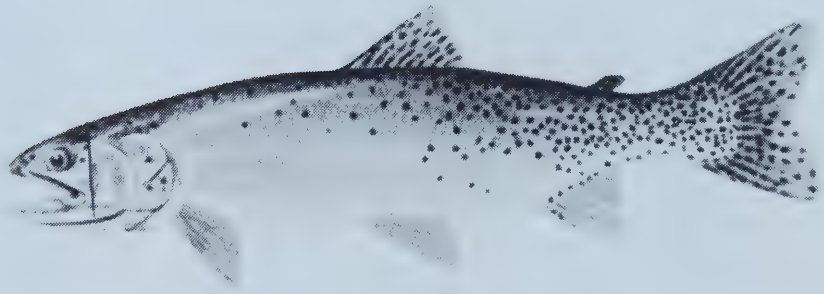


Plate 6. The cutthroat trout (*Salmo clarkii*), shown above, was correctly identified by 33% of the sample. Angler identification knowledge varied immensely for fish and trout food sources.

Plate 7. The subjects' level of knowledge about trout food sources was measured. The adult mayfly (Order Ephemeroptera) seen here was correctly identified by 42% of the sample, but an average of only 17% could correctly identify each of the other invertebrates.

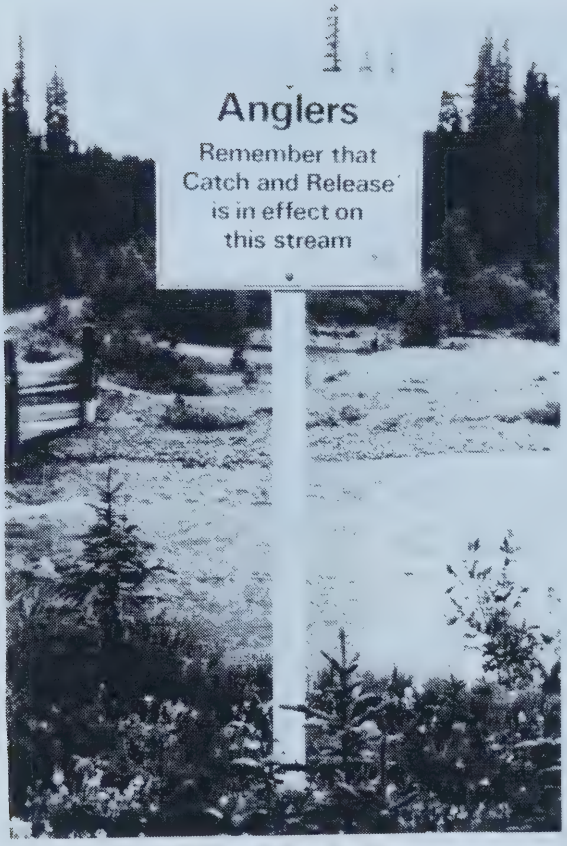


Plate 8. Of all anglers expressing an opinion about the North Ram River catch-and-release program, 90% felt it was worthwhile, 87% supported an expansion and 77% were willing to try angling at such a sport fishery. As many as 46% were even attracted by such a regulation.

Plate 9. Results confirm that fly fishermen are more accepting and supportive of the catch-and-release program than are bait and non-specialists.

Plate 10. As found in related literature, recreational activities are most likely to have begun with family associates. The importance of educating novice anglers through the family and the school system cannot be over-estimated.

X. REFERENCES

Alexander, G.R. and J.R. Ryckman. 1976. Trout production and catch under normal and special angling regulations in the North Branch of the Au Sable River, Michigan. Fish. Research Rep. No. 1840, Michigan, Dept. of Nat. Res.

Allen, S. and S.F. McCool. 1982. Energy conservation, recreation participation, and ecological responsible behavior. In: 'Forest and River Recreation: Research Update', Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN, pp. 111-114.

Arndt, J. 1968g. Insights into consumer behavior. Allyn and Bacon, Boston, MA.

Bagenall, T.B. 1969. The relationship between food supply and fecundity in brown trout *Salmo trutta* L. J. Fish. Biol. 1: 167-182.

Ball, W.K. 1971. Initial effects of catch-and-release regulations on cutthroat trout in an Idaho stream. M.Sc. thesis, Univ. of Idaho.

Beard, J.G. and M.G. Ragheb. 1980. Measuring leisure satisfaction. J. of Leis. Res. 12: 20-33.

Becker, R.H., B.J. Niemann and W.A. Gates. 1981. Displacement of users within a river system: Social and environmental trade-offs. In: 'Some recent products of river recreation research', USDA For. Serv., Gen. Tech. Rep. NC 63, North Cent. For. Exp. Stn., St. Paul, MN, pp. 33-38.

Behnke, R.J. 1980. Special regulations: historical perspective. In: 'Proc. of the 15th Ann. Meeting., Colorado-Wyoming Chapter, Amer. Fish. Soc.', ed. Roy Whaley. Ft. Collins, Colo., pp. 58-63.

Bennis, W.G., K.D. Benne and R. Chim. (eds.) 1981. The planning of change: Readings in the applied behavioral sciences. Hope, Reinhart & Winston, New York, N.Y.

Benson, N.G. and R.V. Bulkley. 1963. Equilibrium yield and management of cutthroat trout in Yellowstone Lake. U.S. Fish Wildl. Serv., Research Rep. No. 62.

Bevins, M.I., R.S. Bond, T.J. Corcoran, K.D. McIntosh and R.J. McNeil. 1968. Characteristics of hunters and fishermen in six Northeastern States. Vt. Agr. Exp. Stn., Burlington, Bull. 656.

Billings, S.J. 1982. Steelhead harvest analysis 1981-82. Fish. Tech. Circ. No. 56. Fish. Mgmt. Sec. and Biometrics Unit, Fish and Wildl. Br., Ministry of Environ., Victoria, B.C.

Bjornn, T.C. 1975a. Personal communication between Wydoski and Bjornn cited in Wydoski 1977.

Bjornn, T.C. 1975b. The St. Joe River cutthroat fishery - a case history of angler preference. In: Proc. Western Assoc. of State Game and Fish Comm.(55). pp. 187-194.

Bjornn, T.C. 1978. Survival, production and yield of trout and chinook salmon in the Lemhi River, Idaho. Forest, Wildl. and Range Exp. Stn. Bull. No. 29, Univ. of Idaho, Moscow.

Black, E.C. 1957a. Alterations in the blood level of lactic acid in certain salmonid fishes following muscular activity. I. Kamloops trout, *Salmo gairdneri*. J. Fish. Research Bd. Canada 14, pp. 117-134.

Black, E.C. 1957b. Alterations in the blood level of lactic acid in certain salmonid fishes following muscular activity. II. Lake trout, *Salvelinus namayacush*. J. Fish. Research Bd. Canada 14.

Black, E.C. 1957c. Alterations in the blood level of lactic acid in certain salmonid fishes following muscular activity. III. Sockeye salmon, *Oncorhynchus nerka*. J. Fish. Research Bd. Canada 14. pp. 807-814.

Black, E.C. 1958. Hyperactivity as a lethal factor in fish. J. Fish. Research Bd. Canada 25. pp. 573-386.

Black, E.C., W. Chiu, F.D. Forbes and A. Hanslip. 1959. Changes in pH, carbonate and lactate of the blood of yearling Kamloops trout (*Salmo gairdneri*) during and following severe muscular activity. J. Fish. Research Bd. Canada 16, pp. 391-402.

Blalock, Jr, H.M. 1979. Social Statistics. Rev. 2nd ed., McGraw-Hill Book Co., New York, N.Y.

Bouck, G.R., R.C. Ball. 1966. Influence of capture methods on blood characteristics and morality in the rainbow trout (*Salmo gairdneri*). Trans. Amer. Fish. Soc. 95(2): 170-176.

Brett, J.R. 1958. Implications and assessments on environmental stress. In: 'The Investigation of Fish - Power Problems', ed. P.A. Larkin, H.R. MacMillan Lectures in Fish., Univ. of British Columbia, Vancouver, pp. 69-83.

Brown, P.J. and D.M. Ross. 1982. Using desired recreation experiences to predict setting preferences. In: 'Forest and River Recreation: Research Update', Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN, pp. 105-110.

Bryan, H. 1974b. Spring-stream flyfishermen: management implications of a specialized leisure subculture. In: 'Proc. of the Amer. Fish. Soc. Mtgs'. Honolulu, Hawaii.

Bryan, H. 1977. Leisure value systems and recreational specialization: the case of trout fishermen. J. of Leis. Res. 9: 174-187.

Bryan, H. 1979. Conflicts in the great outdoors: Toward understanding and managing for diverse sportsmen preferences. Socio. Studies No. 4, Bureau of Public Admin., the Univ. of Alabama, University, Alabama.

Buchanan, T., D.S. Warder, M.A. Collins and G. Phillips. 1982. Assessing the benefits of special fisheries management. In: 'Forest and River Recreation: Research Update'. Misc. Publ. 18, USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN, pp. 58-63.

Buchanan, T., T. Sundstrom, J. Hightower. 1986. Potential contributions of diffusion-adoption theory to understanding human dimensions of wildlife management. Paper presented at 1st National Symposium on the Social Sciences in Resource Management. Oregon State Univ., Corvallis, Oregon.

Buist, L.J. and T.A. Hoots. 1982. Recreation opportunity spectrum approach to resource planning. J. For. 80: 84-86.

Burch, Jr., W.R. 1965. The playworld of camping: Research into the social meaning of outdoor recreation. Amer. J. of Soc. Vol. LXX: 604-612.

Burch, Jr., W.R. 1969. The social circles of leisure: Competing explanations. J. of Leis. Res. 2: 125-147.

Burns, D.C. 1977. Catch-and-release fishing for steelhead in the State of Washington. In: 'Proc. on a Nat. Sport Fishing Symposium: Catch-and-Release Fishing as a Management Tool', eds. R.A. Barnhart and T.D. Roelofs, Humboldt State Univ., Arcata, CA., pp. 161-168.

Butler, J.R. 1983. Challenges and changing perspectives in the management of fish and wildlife resources. Agric. and For. Bull., Univ. of Alberta, Edmonton, pp. 10-13.

Butler, J.R. and R.R. Maw. 1985. Fishing Canada's mountain parks. Lone Pine Publ., Edmonton.

Butler, J.R. and G.D. Fenton. 1986. Bird watchers at Point Pelee National Park, Canada: Their characteristics and activities, with special consideration to their social and resource impacts. Paper presented at 1st National Sympoisum on Social Science in Resource Management, Oregon State Univ., Corvallis, Oregon.

Canada. Statistics Canada. Census 1971.

Canada. Statistics Canada. Census 1981.

Catton, Jr., W.R. 1969. Motivations of wilderness users. In: Woodlands Section, Pulp and Paper Mgmt. of Canada. Dec. 19th. pp. 121-126.

Caverhill, P.A. 1977. The British Columbia experience in catch-and-release fishing. In: 'Proc. on a Nat. Sport Fishing Symp.: Catch-and-Release Fishing as a Mgmt. Tool', ed. R.A. Barnhart and T.O. Roelofs, Humboldt State Univ., Arcata, CA. pp. 151-160.

Chao, L.L. 1974. Statistics: An intuitive approach. Science Res. Assoc. In., Chicago, Ill.

Christensen, J.E., D.R. Yoesting. 1977. The substitutability concept: a need for further development. J. of Leis. Res. 9: 188-207.

Cockrell, D., W.J. McLaughlin. 1982. Social influences on wild river recreationists. In: 'Forest and River Recreation: Research Update'. Misc. Publ. 18, USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN, pp. 49-51.

Dahlgren, R.B., A. Wywialowski, T. Bubolz, V.L. Wright. 1977. Influence of knowledge of wildlife management principles on behavior and attitudes toward resource issues. In: 'Trans. of the 42nd N. Amer. Wildl. and Nat. Res. Conf.', pp. 146-155.

Deinstadt, J.M. 1977. Catch-and-release angling in California's wild trout streams. In: 'Proc. on a Nat. Sport Fishing Symp.: Catch-and-Release Fishing as a Mgmt. Tool', eds. R.A. Barnhart and T.D. Roelofs. Humboldt State Univ. Arcata, CA. pp. 119-124.

Ditton, R.B., R.J. Mertens, M.P. Schwartz. 1978. Characteristics, participation and motivation of Texas charter boat fishermen. Marine Fisheries Review. Paper 1319. 40: 8-13.

Dorfman, P.W. 1979. Measurement and meaning of recreation satisfaction: a case study in camping. Env. and Behav. 11: 483-510.

Dottavio, F.D., J.T. O'Leary, B.A. Koth. 1980. The social group variable in recreation participation studies. J. of Leis. Res. 12: 357-367.

Dunning, D.J. 1978. The attitudes and characteristics of anglers and non-anglers as they relate to sport fishing in Eire County, New York. Ph.D. dissertation, State Univ. of New York at Buffalo.

The Edmonton Journal. 1986. A cultured lot in Cowtown. March 27.

Emerson, R.M. 1968. Games: rules, outcomes and motivation. In: 'AAAS Sym. on the Psychology and Sociology of Sport. Dec., Dallas, Texas.

Falk, M.R., D.V. Gillman and L.W. Dahlke. 1974. Comparison of mortality between barbed and barbless hooked lake trout. Can. Dept. of Environ. Fish and Mar. Serv., Res. Mgmt. Br., Tech. Rep. No. Cen/t-74-1.

Fazio, J.R. and D.L. Gilbert. 1981. Public relations and communications for natural resource managers. Kendall/Hunt Publ. Co., Dubuque, Iowa.

Field, D.R. 1974. Patterns of participation, characteristics and preference of Puget Sound saltwater sportfishermen. State of Washington Water Res. Ctr.

Field, D.R. and J.T. O'Leary. 1973. Social groups as a basis for assessing participation in selected water activities. J. of Lei. Res. 5: 16-25.

Filion, F.L., S.W. James, J.L. Ducharme, W. Pepper, R. Reid, P. Boxall and D. Teillet. 1984. The importance of wildlife to Canadians: highlights of the 1981 national survey. Can. Wildl. Serv., Environ. Can. Ottawa.

Firey, W. 1980. Man, mind and land: a theory of resource use. The Free Press, Glencoe, Ill.

Gilbert, D.L. 1964. Public relations in natural resources management. Burgess Publ. Co., Minneapolis, MN.

Gordon, C.D., D.W. Chapman, T.C. Bjornn. 1969. The preference, opinions and behavior of Idaho anglers as related to quality in salmonid fisheries. In: 'Proc. of the 49th Ann. Conf. West. Assoc. State Game Fish Comm.', June, pp. 98-114.

Graff, D.R. and B.A. Hollender. 1977. Catch-and-release fishing, the Pennsylvania experience. In: 'Proc. on a Nat. Sport Fishing Symp.: Catch-and-Release Fishing as a Management Tool', eds. R.A. Barnhart and T.D. Roelofs. Humboldt State Univ., Arcata, CA. pp. 137-150.

Grant, G.L. 1980. Catching, releasing and tagging Atlantic salmon in Iceland's River Grímsá. In: 'Proc. of the 15th Ann. Mtg. Colorado-Wyoming Chapter, Am. Fish. Soc.', ed. Roy Whaley, Ft. Collins, Colo. pp. 64-70.

Gresswell, R.E. 1976. Hooking mortality in trout. U.S. Dept. Int., Nat. Park Serv., Yellowstone Nat. Park, Info. Paper No. 29.

Griggs, J.D. 1977. Hosmer Lake - Atlantic salmon catch-and-release program. In: 'Proc. on a Nat. Sport Fishing Symp.: Catch-and-Release Fishing as a Management Tool', eds. R.A. Barnhart and T.D. Roelofs. Humboldt State Univ., Arcata, CA. pp. 177-180.

Haig-Brown, R.L. 1975. Fisherman's Spring. New York, Crown.

Harry, J., J.C. Hendee and R.B. Stein. 1972. A sociological criterion for outdoor recreation resource allocation. Paper presented to the Annual Meetings of the Amer. Soc. Assoc., New Orleans.

Heberlein, T.A., J.J. Vaske. 1977. Crowding and visitor conflict on the Bois Brule River. Tech. Ref. WFS WRC 7704, Water Resources Centre, Univ. of Wisconsin, Madison, WI.

Herzon, F.D. and M. Hooper. 1976. Introduction to statistics for the social sciences. Harper and Row, Publ. Inc., New York, N.Y.

Hendee, J.C. 1974. A multiple-satisfaction approach to game management. Wildl. Soc. Bull. 2(3):104-113.

Hendee, J.C. and W.R. Catton, Jr. 1968. Wilderness users ... What do they think? Amer. Forests. Sept.

Hendee, J.C., R.N. Clark and T.E. Dailey. 1977. Fishing and other recreation behavior at high mountain lakes in Washington State. USDA For. Serv. Res. Note, PNW For. and Rang Exp. Stn., Seattle, WA.

Hendee, J.C. and H. Bryan. 1978. Social benefits of fish and wildlife conservation. In. Proc. Jt. Ann. Mtg. of West. Assoc. of Fish and Wildl. Agencies and West. Div. Amer. Fish. Soc., San Diego, CA.

Hendee, J.C., R.P. Gale and W.R. Catton, J.R. 1973. A typology of outdoor recreation activity preferences. J. of Environ. Education. 3(1).

Hendee, J.C. and D.R. Potter. 1971. Human behavior and wildlife management: needed research. In: Trans. 36th N.A. Wildl. and Nat. Res. Conf. March 7-10, pp. 383-396.

Hicks, C.E., L.C. Belusy, D.J. Witter and P.S. Haverland. 1983. Application of angler attitudes and motives to management strategies at Missouri's trout parks. Fisheries 8, pp. 1-7.

Hoaglund, J.F. 1973. A description of anglers and angling in two use areas of the Uinta Mountains. M.Sc. thesis, Utah State Univ., Logan, Utah.

Hogander, G., T.C. Bjornn, S. Pettit. 1974. Evaluation of catch-and-release regulations on cutthroat trout in the North Fork of the Clearwater River. Ann. Progress Rep., F-59-R-5, For. Wildl. and Range Exp. Stn. Univ. of Idaho.

Hooton, R.S. 1982. A questionnaire survey of Vancouver Island steelhead angler's opinions and preferences on management issues. M.Sc. thesis, College of For., Wildl. and Range Sci., Univ. of Idaho, Moscow.

Horak, D.L. and W.D. Klein. 1967. Influence of capture methods on fishing success, stamina and mortality of rainbow trout in Colorado. Trans. Amer. Fish. Soc. 96: 220-222.

Hunsaker, D., L.F. Marnell and F.P. Sharpe. 1970. Hooking mortality of Yellowstone cutthroat trout. Prog. Fish-Cult. 32: 231-235.

Hunt, R.L. 1970. A compendium of research on angling regulations for brook trout conducted at Lawrence Creek, Wisonson. Wisc. Dept. Nat. Res. Research Rep. 54.

Hunt, R.L. 1977. An unsuccessful use of catch-and-release for a wild brook trout fishery. In: 'Proc. on a Nat. Sport Fishing Symposium: Catch-and-Release Fishing as a Management Tool', eds. R.A. Barnhart and T.D. Roelofs, Humboldt State Univ., Arcata, CA, pp. 125-136.

Hunt, R.L. 1981. A successful application of catch-and-release regulations on a Wisconsin trout stream. Tech. Bull. 119. Wisconsin Dept. of Nat. Res., Madison, Wisconsin.

Jackson, R., R. Norton and R. Anderson. 1979. Improving ethnical behavior in hunters. In: 'Trans. of the 44th North Amer. Wildl. and Nat. Resources Conf.', pp. 306-318.

Johnson, T.H. and T.C. Bjornn. 1978. Evaluation of angling regulations in management of cutthroat trout. Idaho Dept. of Fish and Game, Idaho Coop. Fishery. Research Unit, Univ. of Idaho, Proj. No. F-49-R-0.

Jones, R.D., P.E. Bigelow, R.E. Gresswell and R.A. Valdez. 1982. Annual project technical report for 1981. Fishery and Aquatic Mgmt. Program, Yellowstone National Park, U.S. Dept. of the Interior, Fish and Wildl. Serv., Fishery Resources.

Kelly, J.R. 1974. Socialization toward leisure: A developmental approach. J. of Leis. Res. 6: 181-193.

Kennedy, J.J. and P.J. Brown. 1976. Attitudes and behavior of fishermen in Utah's Uinta Primitive Areas. Fish. Bull. of the Amer. Fish. Soc. 1: 15-31.

Kershner, J.L. and R.R. Van Kirk. 1984. Characteristics and attitudes of some Klamath River anglers. Calif. Fish and Game 70: 196-209.

Klein, W.D. 1965. Mortality of rainbow trout caught on single and treble hooks and released. Prog. Fish-Cult. 27: 171-172.

Klein, W.D. 1966. Morality of trout caught on artificial lures and released by fishermen. Trans. Amer. Fish Soc. 95: 326-328.

Klein, W.D. 1972. Influence of special regulations and stocking on fishermen and the trout population at Parvin lake, Colorado. Col. Univ. of Game, Fish and Parks. Tech. Publ. 29.

Knopf, R.C., B.L. Driver and J.R. Bassett. 1973. Motivations for fishing. Trans. North Amer. Wildl, and Nat. Res. Conf. 38: 191-204.

Krumpe, E.E. and P.J. Brown. 1982. Redistributing backcountry use through information related to recreation experiences. J. of For. 80: 360-362.

La Piere, R.T. 1954. A theory of social control. McGraw Hill Publ. Co., New York, N.Y.

Latta, W.C. 1973. The effects of a flies-only fishing regulation upon trout in the Pigeon River, Otsego Country, Michigan. Mich. Dept. of Nat. Res., Research Rep. No. 1807.

Lewynsky, V.A. and T.C. Bjornn. 1983. River and stream investigations: Coeur d'Alene River fisheries investigations. Project F-73-R-4, sub-project IV, study No. XIII, job No. 1, Idaho Dept. of Fish. and Game.

Lime, D.W. and R.C. Lucas. 1977. Good information improves the wilderness experience. Naturalist 28(4):18-20.

London, M., R. Crandell and D. Fitzgibbons. 1977. The psychological structure of leisure: activities, needs, people. J. Leis. Res. 9: 252-263.

Longmore, L.A., K. Brickley and C.E. Stenton. 1982. The sport fishery in Alberta: Facts and figures for 1975 and 1980. Alberta E.N.R., Fish and Wildl. Div., Fisheries Mgmt. Rep. No. 28.

Lowry, H. 1978. Preference survey of Oregon resident and anglers. Survey Research Centre, Oregon State Univ., Corvallis.

Lucas, R.C. 1981. Redistributing wilderness use through information supplied to visitors. USDA For. Serv. Int.-277. Intermountain For. and Range Exp. Stn. Ogden, Utah.

Manfredo, M.J. and D.H. Anderson. 1982. Missouri trout park anglers: their motives and opinions of management. In: 'Forest and River Recreation: Research Update'. Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN, pp. 64-68.

Manning, R.E. 1979. Behavioral characteristics of fishermen and other recreationists on four Vermont Rivers. Fisheries Bull. of the Amer. Fisheries Soc. 108: 536-541.

Manning, R.E. and C.P. Ciali. 1980. Recreation density and user satisfaction: a further explanation of the satisfaction model. J. of Leis. Res. 12: 329-345.

Marnell, L.F. and D. Hunsaker. 1968. Confinement of experimental fish. Prog. Fish-Cult. 30.

Marnell, L.F. and D. Hunsaker II. 1970. Hooking mortality of lure-caught cutthroat trout *Salmo clarkii* in relation to water temperature, fatique, and reproduction maturity of released fish. Trans. Amer. Fish. Soc. 99: 684-688.

Maslow, A.H. 1968. Toward a psychology of being. Van Nostrand Reinhold Co., New York, N.Y.

Mason, R.G. 1964. The use of information sources in the process of adoption. Rural Sociology 29: 40-42.

Mason, I.W. and R.L. Hunt. 1967. Mortality rates of deeply-hooked rainbow trout. Prog. Fish-Cult. 29: 87-91.

McDonough, M.H. 1982. The influence of place on recreation behavior: an ecological perspective. In: 'Forest and River Recreation: Research Update". Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 120-123.

McLaren, J.L. 1970. Vulnerability of wild brown trout to fly fishing under catch and release regulations. M.Sc. thesis. Pennsylvania State Univ. State College.

Moeller, G.H. and J.H. Engelken. 1972. What fishermen look for in a fishing experience. J. Wildl. Mgmt. 36: 1253-1257.

Muth, R.M. and J.C. Hendee. 1980. Technology transfer and human behavior. J. For. 78: 141-144.

Norusis, M.J. 1983. SPSS-X introductory statistics guide. McGraw-Hill Book Co.

Paetz, M.H. 1957. The management of trout streams of the east slopes of the Rocky Mountains in Alberta. M.Sc. thesis. Dept. of Zoology, Univ. of Alberta, Edmonton.

Paetz, M.H. and Nelson, J.S. 1970. The fishes of Alberta. 1st Ed., Government of Alberta: Mines and Minerals.

Parker, R.R. and E.C. Black. 1959. Muscular fatigue and mortality in troll caught chinook salmon (*Oncorhynchus tshawytscha*). J. Fish. Res. Bd. Canada. 16: 95-106.

Parker, R.R., E.C. Black and P.A. Larkin. 1959. Fatigue and mortality in troll-caught pacific salmon (*Oncorhynchus*). J. Fish. Bd. Canada. 16: 429-448.

Peters, D.J. 1983. Western Montana Fisheries Investigation Rock Creek Management Survey, Mont. Proj. No. F-12-R-29, Job IIa.

Pettit, S.W. 1977. Comparative reproductive success of caught-and-release and unplayed hatchery female steelhead trout (*Salmo gairdneri*) from the Clearwater River, Idaho. Trans. Amer. Fish. Soc. 106: 431-435.

Pierce, R.C. 1980. Dimension of leisure. I: satisfactions. J. of Leis. Res. 12: 5-19.

Potter, D.R., J.C. Hendee and R.N. Clark. 1973. Hunting satisfaction: game, gun or nature? In: Trans. of the 38th North Amer. Wildl. and Nat. Res. Conf. pp. 220-228.

Probst, D.B. and D.W. Lime. 1982. How satisfying is satisfaction research? A look at where we are going. In: 'Forest and River Recreation: Research Update'. Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 124-133.

Radford, D.S. 1975. The harvest of fish from Dutch Creek, a mountain stream open to angling on alternate years. Alberta Recreation, Parks and Wildl., Manag. Rep. No. 15.

Radford, D.S. 1980. A progress report on creel survey studies conducted on several high-mountain lakes in S.W. Alberta in 1979. Fish and Wildl. Div., Alberta E.N.R.

Ragheb, M.G. 1980. Interrelationships among leisure participation, leisure satisfaction and leisure attitudes. J. of Leis. Res. 12: 138-149.

Reingold, M. 1975. Effects of displacing, hooking and releasing on migrating adult steelhead trout. Trans. Amer. Fish. Soc. 104: 458-460.

Roberts, W.E. 1983. Personal communication. Curator, Department of Zoology, University of Alberta, Edmonton.

Robertson, R.D. 1982. Visitor knowledge affects visitor behavior. In: 'Forest and River Recreation: Research Update', Misc. Publ. 18. USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 49-51.

Rogers, M. and F.F. Shoemaker. 1971. Communications of innovations -- a cross-cultural approach. 2nd edition. Free Press, New York, N.Y.

Rogers, E.M. 1983. Diffusion of innovations. Free Press, New York, N.Y.

Roggenbuck, J.W. and R.M. Schreyer. 1977. Relations between river trip motives and perception of crowding, management preference, and experience satisfaction. In: 'River Recreation Management and Research Symposium', USDA For. Serv., Gen. Tech. Rep. NC-28, North Cent. For. Stn., St. Paul, MN. pp. 359-364.

Roggenbuck, J.W. and J.H. Schomaker. 1982. Research needs for improved recreation visitor management. In: 'Forest and River Recreation: Research Update', Misc. Publ. 18, USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 1-6.

Schoolmaster, F.A. and J.W. Frazier. 1985. An analysis of angler preferences for fishery management strategies. J. Leis. Sci. 12: 321-342.

Schweibert, E. 1978. Trout: Vol. I-II. E.P. Dutton, New York, N.Y.

Schreyer, R. 1982. Experience level affects expectations for recreation participation. In: 'Forest and River Recreation: Research Update', Misc. Publ. 18, USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 154-159.

Shetter, D.S. 1969b. The effects of certain angling regulations on stream trout populations. In: 'Symp. on Salmon and Trout on Streams'. ed. T.G. Northcote, Univ. of British Columbia, Vancouver, pp. 333-353.

Shetter, D.S. and G. Alexander. 1965. Results of angling under special and normal trout fishing regulations in a Michigan stream. Trans. Amer. Fish. Soc. 94: 219-226.

Shetter, D.S. and G.R. Alexander. 1966. Angling and trout populations on the North Branch of the Au Sable River, Crawford and Ostego Counties, Michigan, under special and normal regulations, 1958-1963. Trans. of the Amer. Fish. Soc. 95: 85-91.

Shetter, D.S. and L.N. Allison. 1955. Comparison of mortality between fly-hooked and worm-hooked trout in Michigan streams. Michigan Dept. Conserv., Inst. Fish Res., Misc. Publ. No. 9.

Stankey, G.H., R.C. Lucas and R.R. Ream. 1973. Relationships between hunting success and satisfaction. In: 'Trans. of the 38th North Amer. Wildl. and Nat. Res. Conf.', Wash. D.C. pp. 235-242.

Stringer, G.E. 1967. Comparative hooking mortality using three types of terminal gear on rainbow trout from Pennask Lake, British Columbia. Can. Fish. Cult. 39: 17-21.

Stroud, R.H. 1977. Changing challenges in recreational fishing. SFI Bull. 284: 1-6.

Talhelm, D.R. 1973. Defining and evaluating recreation quality. Trans. North Amer. Wildl. and Nat. Res. Conf., 38: 20-28.

Varley, J.D. 1979. Catch-and-release fishing in Yellowstone Park. Paper presented at Wild Trout II Symp. Yellowstone National Park.

Vaske, J.J. and M.P. Donnelly. 1982. Predicting alternative resource choices. In: In: 'Forest and River Recreation: Research Update', Misc. Publ. 18, USDA For. Serv., North Cent. For. Exp. Stn., St. Paul, MN., pp. 85-88.

Vaske, J.J., M.P. Donnelly, T.A. Heberlein and B. Shelby. 1982. Differences in reported satisfaction ratings by consumptive and non-consumptive recreationists. J. Leis. Res. 195-206.

Warner, J. 1979. British Columbia resident freshwater angler survey. Federal-Provincial Salmonid Enhancement Program.

Warner, K. 1978. Hooking morality of lake-dwelling landlocked Atlantic salmon (*Salmo salar*). Trans. Amer. Fish. Soc. 107: 518-522.

Warner, K. and P.R. Johnson. 1978. Mortality of landlocked Atlantic salmon (*Salmo salar*) hooked on flies and worms in a river nursery area. Trans. Amer. Fish. Soc. 107: 772-775.

Watson, A.E. 1980. Technology transfer: lateral diffusion of innovation in forest recreation planning and management. M.Sc. thesis, Polytechnic Inst. and State Univ., Blacksburg, Virginia.

Wedemeyer, G. 1972. Some physiological consequences of handling stress in the juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). J. Fish. Research Bd. Can. 29: 1730-1738.

Williams, D.R. and R.C. Knopf. 1985. In search of the primitive-urban continuum: the dimensional structure of outdoor recreation settings. Environment and Behavior 17: 351-370.

Wydoski, R.S. 1976. Angler responses to special regulations. Annu. Conf. West Assoc. Game Fish Comm. Proc. 56, pp. 154-167.

Wydoski, R.S. 1977. Relation of hooking mortality and sublethal hooking stress to quality fishery management. In: 'Proc. on a Nat. Sport Fishing Sym.: Catch-and-Release Fishing as a Management Tool', eds. R.A. Barnhart and T.D. Roelofs, Humboldt State Univ., Arcata, Ca., pp. 43-88.

Zern, E. 1978. Quality fishing: what is it? Field and Stream 83: 70-72, 74.

XI. APPENDIX

SURVEY QUESTIONNAIRE FORM

RECREATION USER ANALYSIS OF SPORTFISHERMEN : 1983

Initials of Interviewer:_____

Location: _____Subject No. _____

Time _____ 24h, Date (Day/Mo.)_____

Respondent Description:

_____

_____

Introduction

Good-Day / Hi!

I'm doing a creel census interview on this stream for the Fish and Wildlife Division and I'd appreciate getting an idea of how successful your fishing has been today.

1. About how many hours have you been fishing today?

Hours fished: _____

2. How many more hours do you plan to fish?

Future hours _____

3.A. How many fish have you caught? _____

3.B. How many fish have you kept?_____

4.A. Approximately how many years have you fished? _____

4.B. How many days did you fish last year? _____

5. What would you prefer to catch of these three choices?

_____Many small fish or

_____Several medium sized fish, or

_____A couple of large fish

6. The majority of time you are fishing, what percentage of your time do you spend using:

_____ Natural bait,

_____ Artificial lures, or

_____ Flies?

7.A. Could you list at least three other recreation activities that you participate in when on a fishing trip, besides fishing?

Rank	Activity	Rank	Activity
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

7.B. Which of these is the most important to you? Next most important? (NOTE: If more than three activities are listed, ASK: The third most important?) Mark ranks above.

7.C. How important to you is fishing in comparison with these other activities?

_____

8. From what sources do you obtain most of your information about:

8.A. General fishing information- what is your primary source?

_____

8.B. Specific rules and regulations - what is your primary source?

_____

9. Of your fishing experiences, what percentage is spent fishing for trout? _____

10.A. Please tell me the primary reason you chose to fish this stream?

_____

_____

NOW I'D APPRECIATE GETTING YOUR OPINION ON SOME OF YOUR PERSONAL FISHING PREFERENCES . . .

11.A. Does the presence of other anglers, not in your own party, affect your experience in any way?

_____

01 YES

02 NO

88 N.A.

99 D.K.

11.B. If YES, In what way?

_____

_____

12. How many anglers would you have to encounter along the stream in a day, before your fishing experience diminishes?

_____ Number of anglers

13.A. Do you normally release fish?

(YES: GO TO 13B, NO: GO TO 14).

_____

01 YES

02 NO

88 N.A.

99 D.K.

13.B. Why do you do so?

_____

_____

14. What is a quality fishing experience to you?

_____

_____

NOW, I HAVE SOME QUESTIONS RELATING DIRECTLY TO THE EXPERIMENTAL CATCH-AND-RELEASE REGULATION ON THE NORTH RAM RIVER. . .

15. Could you explain your understanding of the purpose of the catch-and-release program?

16. A Is the catch-and-release program a worthwhile idea?

01 YES

02 NO

88 N.A.

99 D.K.

16.B. Would you try it (catch-and-release)?

01 YES

02 NO

88 N.A.

99 D.K.

17. Can a fish be released without being seriously damaged?

_____

01 YES

02 NO

88 N.A.

99 D.K.

18.A. Should the catch-and-release trout management program be expanded in Alberta?

_____

01 YES

02 NO

88 N.A.

99 D.K.

18.B. Why?

_____

_____

19.A. Did you fish the North Ram River before the catch-and-release regulation came into effect?

_____

01 YES

02 NO

88 N.A.

99 D.K.

19.B. Did the catch-and-release regulation on the North Ram discourage you from fishing there?

_____

01 YES

02 NO

88 N.A.

99 D.K.

19.C. Why?

_____

_____

20.A. Is the catch-and-release trout management program attractive to you?

_____

01 YES

02 NO

88 N.A.

99 D.K.

20.B. Why?

_____

_____

21.A. Do you either agree or disagree with the experimental catch-and-release program on the North Ram River?

_____

01 YES

02 NO

88 N.A.

99 D.K.

21.B. Why?

_____

22.A. Have you previously tried fishing under a catch-and-release trout management program?

_____

01 YES(GO TO 22B)

02 NO (GO TO 22C)

88 N.A.

99 D.K.

22.B.Where?

_____

23.A. Do you think the North Ram River should remain under the catch-and-release program permanently?

_____

01 YES

02 NO

88 N.A.

99 D.K.

23.B. Why?

24. To reduce the number of fish taken from any given Alberta trout fishery in order to maintain the fish population, what would you prefer to see management do?

25.A. Are you a member of an organization concerned with fish and/or wildlife? (YES, GO TO 25B, NO, GO TO 26)

01 YES

02 NO

88 N.A.

99 D.K.

25.B. What organization(s)?

AS ONE OF THOSE WHO PROFESS TO FISH, I'M NOT THAT KNOWLEDGEABLE ABOUT FISH IDENTIFICATION, BUT I'D LIKE TO FIND OUT WHERE YOUR LEVEL OF KNOWLEDGE ABOUT FISH MIGHT BE. THESE NEXT TWO QUESTIONS RELATE TO IDENTIFYING BOTH DIFFERENT SPECIES OF FISH AND TROUT FOOD SOURCES.

26. Please identify as many of these fish as you can by common name:

YES/NO Walleye

YES/NO Cutthroat Trout

YES/NO Rainbow Trout

YES/NO Brook Trout

YES/NO Arctic Grayling

27. Please identify as many of these local trout food sources as you can by common name:

YES/NO Adult Caddisfly

YES/NO Adult Stonefly

YES/NO Adult Mayfly

YES/NO Stonefly Nymph

YES/NO Mayfly Nymph

THANKS FOR YOUR EFFORT, WE CAN COME BACK TO THESE IN A MOMENT IF YOU'D LIKE. I'M SURE YOU DID AS WELL AS THE OTHERS, SO DON'T WORRY ABOUT IT.

THE LAST FEW QUESTIONS WON'T TAKE LONG AT ALL. AS PART OF OUR STUDY, WE ARE INTERESTED IN SOME BASIC SOCIO-DEMOGRAPHIC DESCRIPTORS FOR STATISTICAL PURPOSES.

28. Where do you live?_____

29. Would you say your background has been predominately:

_____

01 RURAL

02 URBAN

88 N.A.

99 D.K.

30. Could you describe the type of work you do for a living?

_____

31. What is your educational level?_____

_____

32. What is your birth year? _____

THAT'S ALL OF MY QUESTIONS, WOULD YOU LIKE TO ASK ANY QUESTIONS YOURSELF?

B45631